3 AFFECTED ENVIRONMENT

This EIS considers the proposed action of building and operating a conversion facility at the Portsmouth site for conversion of the Portsmouth and ETTP DUF_6 cylinder inventories. Section 3.1 presents a detailed description of the affected environment for the Portsmouth site. Because the option of shipping cylinders from the ETTP site in Oak Ridge, Tennessee, to the Portsmouth site for conversion is part of the proposed action, a detailed description of the affected environment for the ETTP site is provided in Section 3.2.

3.1 PORTSMOUTH SITE

The Portsmouth site is located in Pike County, Ohio, approximately 22 mi (35 km) north of the Ohio River and 3 mi (5 km) southeast of the town of Piketon (Figure 3.1-1). The two largest cities in the vicinity are Chillicothe, located 26 mi (42 km) north of the site, and Portsmouth, 22 mi (35 km) south.

The Portsmouth site includes the Portsmouth Gaseous Diffusion Plant (PORTS), a gaseous diffusion plant previously operated first by DOE and then by USEC. Uranium enrichment operations at PORTS were discontinued in May 2001, and the plant has been placed in cold standby, a nonoperational condition in which the plant retains the ability to resume operations within 18 to 24 months (DOE 2001c).

The Portsmouth site occupies 3,714 acres (1,500 ha) of land, with an 800-acre (320-ha) fenced core area that contains the former production facilities. The 2,914 acres (1,180 ha) outside the core area includes restricted buffers, waste management areas, plant management and administrative facilities, gaseous diffusion plant support facilities, and vacant land (Martin Marietta Energy Systems, Inc. [MMES] 1992b). Wayne National Forest borders the plant site on the east and southeast, and Brush Creek State Forest is located to the southwest, slightly more than 1 mi (1.6 km) from the site boundaries.

The Portsmouth site is not listed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Priorities List. Investigation and cleanup of hazardous substances (as defined in CERCLA) and hazardous wastes (as defined in the RCRA) that have been released to air, surface water, groundwater, soils, and solid waste management units as a result of past operational activities at the Portsmouth site are being conducted under the provisions of the following administrative edicts, which have been issued pursuant to RCRA, CERCLA, and/or Ohio state law:

- State of Ohio v. U.S. Department of Energy, Divested Atomic Corporation, et al., Consent Decree. Civil Action C2-89-732. August 31, 1989 (referred to as the 1989 Ohio Consent Decree). The 1989 Ohio Consent Decree addresses certain hazardous waste compliance issues at the Portsmouth site and requires the performance of corrective actions in addition to other requirements.

- In the Matter of United States Department of Energy: Portsmouth Gaseous Diffusion Plant, Administrative Consent Order. U.S. Environmental Protection Agency (EPA) Administrative Docket No. OH7 890 008 983. August 12, 1997 (agreement between DOE, U.S. EPA, and Ohio EPA) (referred to as the 1997 Three-Party Administrative Consent Order). The 1997 Three-Party Administrative Consent Order replaced a prior U.S. EPA Administrative Consent Order, which was issued during 1989 and amended in 1994, and defines oversight roles at the Portsmouth site for the Ohio EPA and U.S. EPA with respect to corrective action/response action activities. It also defines certain cleanup performance obligations for DOE.

- In the Matter of United States Department of Energy and Bechtel Jacobs Company LLC, Director's Final Findings and Orders. March 17, 1999 (referred to as the 1999 Ohio Integration Order). The 1999 Ohio Integration Order integrates the closure requirements for specified units at the Portsmouth site as established under the 1989 Ohio Consent Decree, the Ohio Administrative Code, and the 1997 Three-Party Administrative Consent Order. The purpose of this integration is to avoid duplication of effort, and efficiently perform site-wide groundwater monitoring and surveillance and maintenance activities at the Portsmouth site.

3.1.1 Cylinder Yards

The Portsmouth site has a total of 16,109 DOE-managed cylinders containing DUF_6 (Table 3.1-1). The cylinders are located in two storage yards that have concrete bases (Figure 3.1-2). The cylinders are stacked two high to comply with DNFSB requirements. All 10- and 14-ton (9- and 12-t) cylinders stored in these yards have been or are being inspected and repositioned. They have been placed on new concrete saddles with sufficient room between cylinders and cylinder rows to permit adequate visual inspection of cylinders.

TABLE 3.1-1 DOE-Managed DUF_6 Cylinders at the Portsmouth Site

Cylinder Type	No. of Cylinders
Full	16,018
Partially full	42
Heel	49
Total	16,109

Source: Hightower (2004).

3.1.2 Site Infrastructure

The Portsmouth site has direct access to major highway and rail systems, a nearby regional airport, and barge terminals on the Ohio River. Use of the Ohio River barge terminals requires transportation by public road from the Portsmouth site.

The Portsmouth site obtains its water supply from an on-site water treatment plant that draws water from off-site supply wells on the Scioto River. In 2001, total groundwater production from this system averaged 6.6 million gal/d (25 million L/d) for the site, including USEC activities (DOE 2002d).

The Ohio Valley Electric Corporation supplies the site with electrical power. The current electrical consumption is about 20 to 40 MW; the maximum electrical design capacity is 2,260 MW.

3.1.3 Climate, Air Quality, and Noise

3.1.3.1 Climate

The Portsmouth site is located in the humid continental climatic zone and has weather conditions that vary greatly throughout the year (DOE 2001c). For the 1961 through 1990 period in Waverly, about 10 mi (16 km) north of the site, the annual average temperature was 52.9°F (11.6°C), with the highest monthly average temperature of 74.1°F (23.4°C) in July and the lowest of 28.8°F (–1.8°C) in January (National Oceanic and Atmospheric Administration [NOAA] 2000). Record extreme maximum and minimum temperatures are 102°F (39°C) and –24°F (–31°C). Annual precipitation averages about 39.7 in. (100.7 cm). Precipitation is relatively evenly distributed throughout the year but is somewhat higher in spring and summer than in winter and fall. Snowfall in Portsmouth averages 17.3 in. (43.9 cm) per year, occurring from November to April. Annual average relative humidity in Columbus, Dayton, and Cincinnati was more than 70% (Wood 1996).

Surface meteorological data, including wind data, have been collected at the on-site meteorological tower at the 10-, 30-, and 60-m (33-, 98-, and 197-ft) levels. The tower is in the southern part of the site. A comparison of annual wind roses for the period 1995 through 2001 indicates that wind patterns at the 10-m (33-ft) level are different from those at the 30-m and 60-m (98- and 197-ft) levels. Winds at the 10-m (33-ft) level appear to be influenced by local topographical and/or vegetative features. Accordingly, wind data at the 30-m (98-ft) level, believed to be representative of the site, are presented in Figure 3.1-3, which was prepared on the basis of hourly surface data from the on-site tower (Takacs 2002). More than 40% of the time, wind blew from the southwest quadrant, with the prevailing wind being from the south. Average wind speed was about 6.2 mph (2.8 m/s). Directional wind speed was highest, at 7.4 mph (3.3 m/s), from the northwest, and it was lowest, at 4.0 mph (1.8 m/s), from the east.

Tornadoes are rare in the area surrounding the Portsmouth site, and those that do occur are less destructive in this region than those occurring in other parts of the Midwest. For the 1950 through 1995 period, 656 tornadoes were reported in Ohio, with an average of 14 tornadoes per year (Storm Prediction Center 2002). For the same period, 3 tornadoes were reported in Pike County, but most of those were relatively weak — at most, F2 of the Fujita tornado scale.

3.1.3.2 Existing Air Emissions

Nonradiological air emissions from USEC are predominant sources in Pike County (EPA 2003b). Currently, USEC has three OEPA operating permits. The Title V permit for USEC

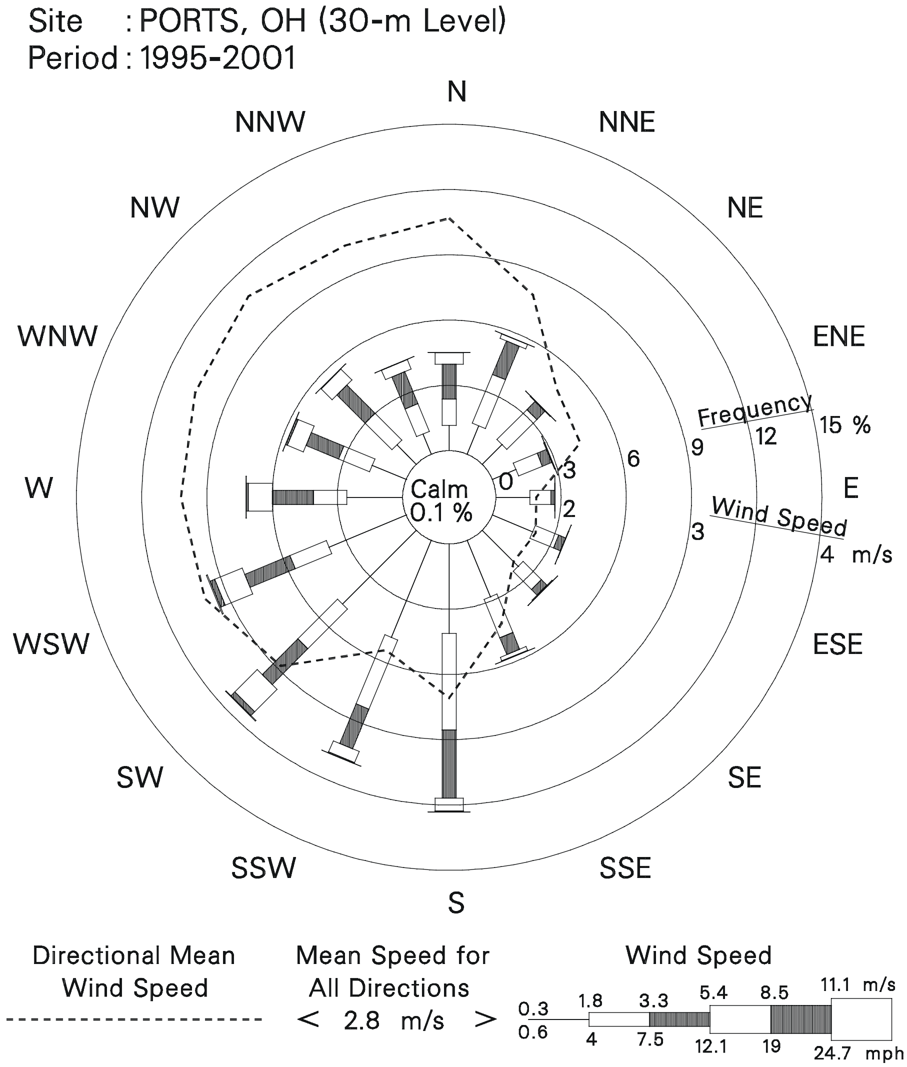

FIGURE 3.1-3 Wind Rose for the Portsmouth Site (30-m level), 1995–2001 (Source: Takacs 2002)

operations has been issued and was effective August 21, 2003, which is a sitewide, federally enforceable operating permit to cover emissions of all regulated air pollutants at the facility. In submissions to the OEPA, USEC reported the following criteria pollutant emissions for the year 2001 (see Table 3.1-2): 59.86 tons (54.30 t) of particulate matter with a mean diameter of 10 μm or less (PM_{10}), 1.42 tons (1.29 t) of volatile organic compounds (VOCs), 2,627.64 tons (2,473.57 t) of SO_2, and 362.05 tons (328.45 t) of NO_x. These emissions are associated with the boilers at the X-600 steam plant (which provides steam for the Portsmouth reservation), a boiler at the X-611 water treatment plant, an emergency generator, and a trash pump (DOE 2002d). DOE operates numerous small sources that release criteria pollutants and VOCs. At the end of 2001, DOE had eight permitted and seven registered air emission sources (Richmond 2003). In November 2001, DOE began operation of the X-6002 recirculating hot water plant to provide heat for the DOE facilities that were formerly heated by hot water from the gaseous diffusion

TABLE 3.1-2 Annual Criteria Pollutant and Volatile Organic Compound Emissions from USEC and DOE Sources at the Portsmouth Site in 2001

	Emission Rate (tons/yr)					
Major Emission Source	SO_2	NO_x	CO	VOCs	PM_{10}	$PM_{2.5}$
USEC facilities[a]	2,627.64	362.05	NA[b]	1.42	59.86	NA
DOE facilities[c]	21.5	93.6	58.5	5.7	5.3	NA

[a] Source: DOE (2002d).

[b] NA = not available.

[c] Proposed maximum annual emissions based on the assumption that two boilers would operate full time.

Source: Richmond (2003).

process. Proposed maximum annual emissions from plant operations account for most of the DOE emissions (Richmond 2003) (see Table 3.1-2). Other emission sources at DOE, which include two landfill venting systems, two glove boxes (not used in 2001), two aboveground storage tanks in the X-6002A fuel oil storage facility, and two groundwater treatment facilities, emit less than 1 ton per year of conventional air pollutants (on an individual basis).

Airborne discharges of radionuclides from the Portsmouth site are regulated under the CAA, 40 CFR 61, Subpart H, National Emission Standards for Hazardous Air Pollutants (NESHAPs). Currently, USEC is responsible for most of the sources that emit radionuclides because DOE leased the production facilities to USEC. In 2001, USEC and DOE reported emissions of 0.2 and 0.00063 Ci from their radionuclide emission sources, respectively. These values were used to estimate doses to members of the general public (DOE 2002d).

3.1.3.3 Air Quality

The Ohio State Ambient Air Quality Standards (SAAQS) for six criteria pollutants — SO_2, nitrogen dioxide (NO_2), CO, ozone (O_3), PM (PM_{10} and $PM_{2.5}$), and lead (Pb) — are the same as the National Ambient Air Quality Standards (NAAQS)[1] (OEPA 2002), as shown in Table 3.1-3.

The Portsmouth site is located in the Wilmington-Chillicothe-Logan Intrastate Air Quality Control Region (AQCR), which covers the south-central part of Ohio. Currently, Pike county is designated as being in attainment for all criteria pollutants (40 CFR 81.336). Ambient concentration data for criteria pollutants around the site are not available. On the basis of

1 The EPA promulgated new O_3 8-hour and $PM_{2.5}$ standards in July 1997.

1997 through 2002 monitoring data, the highest concentration levels for SO_2, NO_2, CO, PM_{10}, and Pb representative of the Portsmouth site are less than 64% of their respective NAAQS, as listed in Table 3.1-3 (EPA 2003b). However, the highest O_3 and $PM_{2.5}$ concentrations are approaching or somewhat higher than the applicable NAAQS. These high ozone concentrations of regional concern are associated with high precursor emissions from the Ohio Valley region and long-range transport from southern states.

Ambient air monitoring stations in and around the site consist of a network of 15 air samplers that primarily collect data on radionuclides released from the site. These data are used to assess whether air emissions from the Portsmouth site would affect air quality in the surrounding area. If a person lived close to a monitoring station, the net dose calculated was 0.00019 mrem/yr, which is well below the 10-mrem/yr NESHAPs limit applicable to Portsmouth (see Section 3.1.7.1). In addition to the radionuclides, samples for fluoride were collected weekly from 15 ambient monitoring stations in and around PORTS. In 2001, the average ambient concentrations were similar to or less than those collected at the background station, except for a station that is within the process area immediately east of the X-326 building.

Prevention of significant deterioration (PSD) regulations (40 CFR 52.21) limit the maximum allowable incremental increases in ambient concentrations of SO_2, NO_2, and PM_{10} above established baseline levels, as shown in Table 3.1-3. The PSD regulations, which are designed to protect ambient air quality in Class I and Class II attainment areas, apply to major new sources and major modifications to existing sources. The nearest Class I PSD areas are Otter Creek Wilderness Area in West Virginia, about 177 mi (285 km) east of the Portsmouth site; Dolly Sods Wilderness Area in West Virginia, about 193 mi (311 km) east of the site; and Mammoth Cave National Park in Kentucky, about 200 mi (322 km) southwest of the site. These Class I areas are not located downwind of prevailing winds at the Portsmouth site (see Figure 3.1-3).

3.1.3.4 Existing Noise Environment

The Noise Control Act of 1972, along with its subsequent amendments (Quiet Communities Act of 1978; 42 USC 4901–4918), delegates authority to the states to regulate environmental noise and directs government agencies to comply with local community noise statutes and regulations. The State of Ohio and Pike County, where the Portsmouth site is located, have no quantitative noise-limit regulations.

The EPA has recommended a maximum noise level of 55 dB(A) as the DNL to protect against outdoor activity interference and annoyance (EPA 1974a). This level is not a regulatory goal but is “intentionally conservative to protect the most sensitive portion of the American population” with “an additional margin of safety.” For protection against hearing loss in the general population from nonimpulsive noise, the EPA guideline recommends an L_{eq}(24 h) of 70 dB(A) or less.[2]

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[2] L_{eq} is the equivalent steady sound level that, if continuous during a specific time period, would contain the same total energy as the actual time-varying sound. For example, L_{eq}(24 h) is the 24-hour equivalent sound level.

The noise-producing activities within the Portsmouth site are associated with processing and construction activities and local traffic, similar to those at any other typical industrial site. During site operations, noise levels near the cooling towers are relatively high, but most noise sources are enclosed in the buildings. Currently, the site is in cold standby mode, so no major noise-producing activities exist on site. Another noise source is associated with rail traffic in and out of the Portsmouth site. In particular, train whistle noise, at a typical noise level of 95 to 115 dB(A), is high at public grade crossings. Currently, rail traffic noise is not a factor in the local noise environment because of infrequent traffic (one train per week).

The Portsmouth site is in a rural setting, and no residences or other sensitive receptor locations (e.g., schools, hospitals) exist in the immediate vicinity of any noisy on-site operations. (The nearest sensitive receptor is located about 1 mi (2 km) from Location A for the proposed conversion facility.) Ambient sound level measurements around the site are not currently available; the ambient noise level around the site is relatively low, however, except for infrequent vehicular noise. In general, the background environment is typical of rural areas; day-night average sound level (DNL) from the population density in Pike County is estimated to be about 40 dB(A) (EPA 1974b).

3.1.4 Geology and Soil

3.1.4.1 Topography, Structure, and Seismic Risk

The topography of the Portsmouth site area consists of steep hills and narrow valleys, except where major rivers have formed broad floodplains. The site is underlain by bedrock composed of shale and sandstone.

The Portsmouth site is situated within the Appalachian Plateau Physiographic Province of the Appalachian Highland region near its northwestern terminus at the Central Lowlands Province. The Appalachian Plateau is characterized by deeply dissected valleys and nearly accordant ridge tops. The summits of the main ridges just east of the Scioto River rise to an altitude of more than 1,100 ft (355 m) above mean sea level, with relief of up to 500 ft (150 m) from the bottom of the valleys.

Portsmouth is located within the Portsmouth paleoriver valley. Surface and near-surface geology at the site have been heavily influenced by glaciation and the resultant ice damming and drainage reversals. The site is located in an abandoned river valley that was filled with lacustrine (lake) sediments deposited during the existence of prehistoric Lake Tight (Rogers et al. 1988). The sedimentary units of interest at the site are, in ascending order, Ohio Shale, Bedford Shale, Berea Sandstone, Sunbury Shale, Cuyahoga Shale, Gallia Sand, and Minford Clay.

The Ohio Shale is 300 to 400 ft (90 to 120 m) thick at the site. It is black and thinly bedded and may contain oil. The Bedford Shale consists of interbedded thin sandstone and shale. The Berea Sandstone has a larger sand content than the Bedford Shale but is otherwise similar. At the site, the Berea Sandstone forms an aquifer that has an average thickness of about 30 ft (9 m). The Sunbury Shale is a black carbonaceous shale. This unit thins from east to west and may be completely absent in western portions of the site (ANL 1991b). The Teays Formation overlies the Sunbury Shale and is made up of Gallia Sand (unconsolidated Quaternary deposit) and Minford Clay (unconsolidated Quaternary deposit), in ascending order. These unconsolidated deposits have a fluvial origin and occupy paleochannels of the Teays River System. The Gallia Sand member is a silty to clayey, coarse to fine-grained sand with a pebble base. The Minford Clay member contains interbedded silts and clays and is divided into two zones: an upper zone of clay and a lower zone of silty clay.

The Portsmouth site is within 60 mi (96 km) of the Bryand Station-Hickman Creek Fault (ANL 1991b). No correlation has been made between this fault and historical seismicity. Seismic Source Zone 60 is a north-northeast-trending zone in central and eastern Ohio and includes the Portsmouth site.

The largest recorded seismic event in this zone was the Sharpsburg, Kentucky, earthquake of July 1980. That earthquake registered a magnitude of 5.3 and a Modified Mercalli intensity of VII. For this site, the evaluation-basis earthquake (EBE) was designated by DOE to have a return period of 250 years. A detailed analysis indicated that the peak ground motion for the EBE was approximately 0.06 times the acceleration of gravity (LMES 1997c). The estimated mean value of peak ground acceleration for a 1,000-year return period is 0.11 times the acceleration of gravity (ANL 1991b). Ground motion from such an earthquake would be equivalent to a Class VI or VII earthquake.

3.1.4.2 Soils

A majority of the soils at Portsmouth are formed on alluvial and lacustrine deposits. Other important soil-forming materials are parent material, colluvium, and loess (windblown material) (ANL 1991b). Approximately 1,500 acres (600 ha) of the site consists of moderately drained soils of the Urban Land-Omulga silt loam complex. The Omulga soil at the site is a dark grayish brown silt loam about 10-in. (25-cm) thick. Beneath this layer is about 54 in. (137 cm) of yellowish-brown subsoil. This material is characterized by a friable silt loam, a silty clay fragipan (low-permeability layer), and, near the bottom, a friable silt loam. Within the fragipan, the subsoil has slow permeability. Other soils of Portsmouth include the Clifty and Wilbur silt loams, which occur in stream valleys. The uplands areas contain a mixture of Coolville, Blairton, Latham, Princeton, Shelocta, and Wyatt soils. A description of these soils is provided in Hendershot et al. (1990).

The substances in soil that might be associated with cylinder management activities at the Portsmouth site are uranium and fluoride compounds, which could be released if breached cylinders or faulty valves were present. In 2001, soil was sampled for radioactive parameters, including uranium, at 24 on-site, 18 off-site, and 4 background locations (DOE 2002c). Analytical results for all off-site and most on-site sampling locations were similar to background values. Concentrations of uranium ranged from 2.1 to 23.3 μg/g, with the maximum at sampling location RIS-19, adjacent to the X-705 decontamination building (DOE 2002c). This area is known to be contaminated from historical small spills; the source of uranium was not considered to be the cylinder storage yards. Fluoride has not been analyzed in soil samples, but it occurs naturally in soils and is low in toxicity.

After a March 1978 cylinder handling accident, soil samples were collected to determine whether the X-745-C and X-745-B yards were contaminated (Geraghty & Miller, Inc. 1994a). Total uranium concentrations in the X-745-C yard did not appear to be elevated; they ranged from 2.2 to 4.4 µg/g. VOCs, semivolatile organic compounds (SVOCs), and PCBs were detected in shallow soil samples at maximum concentrations up to about 3 µg/g (for polycyclic aromatic hydrocarbons [PAHs]). Although a few VOCs were detected at low concentrations in groundwater from one well, the source is unlikely to be the X-745-C yard (Geraghty & Miller, Inc. 1994a).

Contaminant concentrations in the X-745-B yard were elevated in some soil samples, ranging from 2.7 to 352 µg/g (for the PAH phenanthrene). However, no uranium, VOCs, SVOCs, or PCBs were detected in groundwater associated with the X-745-B yard. The contamination was confined to shallow soils and limited to the immediate proximity of the unit (Geraghty & Miller, Inc. 1994b).

An investigation of Location A soils was conducted in 2000 (Tetra Tech, Inc. 2000). Six surface soil samples (collected from depths of 0 to 1 ft [0 to 35 cm]) were obtained, and 23 subsurface soil samples were collected from soil borings at the same locations as those where the surface soil samples were collected. Samples were analyzed for VOCs, SVOCs, PCBs, and radionuclides. No organic compounds or PCBs were detected in surface or subsurface soil samples. In one soil boring location, alpha activity was detected at a concentration slightly greater than background in both the surface and subsurface samples (i.e., 5.2 pCi/g in a surface and subsurface soil sample versus 4.8 pCi/g background). Overall, the characterization data did not indicate soil contamination at Location A.

No characterization of soils in Locations B and C has been conducted. There is no known past or current source of contamination at either of these locations.

3.1.5 Water Resources

The affected environment for water resources consists of surface water within and in the vicinity of the site boundary and groundwater beneath the site. Analyses of surface water, stream sediment, and groundwater samples indicated the presence of some contamination resulting from previous gaseous diffusion plant operations.

3.1.5.1 Surface Water

The Portsmouth site is within the Scioto River drainage basin. Both surface water and groundwater drain from the plant via a network of tributaries to the Scioto River (Rogers et al. 1988). The average flow in the Scioto River measured at Higby by the U.S. Geological Survey

(USGS) between 1930 and 1973 was 2.1×10^6 gal/min (133 m^3/s). The 10-year low-flow discharge at Higby is 1.4×10^5 gal/min (8.58 m^3/s).

The Portsmouth site is drained by several small tributaries of the Scioto River (Figure 3.1-4). The largest stream on the plant property is Little Beaver Creek, which drains the northern and northeastern portions of the site before discharging into Big Beaver Creek. Upstream of the plant, Little Beaver Creek flows intermittently during the year. On site, it receives treated process wastewater from a holding pond (via the east drainage ditch) and storm water runoff from the northwestern and northern sections of the plant via several storm sewers, water courses, and the north holding pond. The average release to Little Beaver Creek for 1993 was 940 gal/min (0.06 m^3/s).

Storm sewers H, F, and G on the southern end of the plant site discharge to the south holding pond. This pond overflows to Big Run Creek, another intermittent stream that discharges into the Scioto River. A small unnamed intermittent watercourse drains the southwest corner of the site via the southwest holding pond. Farther north on the property, there is another intermittent watercourse that receives runoff from the central and western portions of the site via the west drainage ditch. All of these streams flow directly to the Scioto River and carry only storm water runoff.

At the Portsmouth site, DOE is responsible for 6 National Pollutant Discharge Elimination System (NPDES) outfalls, and USEC is responsible for 11 NPDES outfalls (DOE 2002d). Total uranium discharge in 2001 from DOE outfalls was estimated as 1.2 kg (2.7 lb); total uranium discharge in 2001 from USEC outfalls was estimated as 16.2 kg (35.8 lb).

In addition to NPDES outfall monitoring, surface waters are monitored for radioactive contamination at 14 locations, including locations upstream and downstream from the Portsmouth site. The surface water monitoring results for 2001 indicated that the measured radioactive contamination was consistently less than the applicable drinking water standards (DOE 2002c,d). Uranium concentrations were detected at levels similar to those that occurred naturally in the Scioto River surface water sampling locations in 2000. Tc-99 was detected at 43 pCi/L in a sample collected downstream of Little Beaver Creek; this level is well below the DOE derived concentration guide of 100,000 pCi/L (DOE 2002d). In addition, in 2001, surface water samples were collected monthly from five locations at the DOE cylinder storage yards and analyzed for total uranium, uranium isotopes, TRU, and Tc-99. The maximum detected concentration of uranium in these samples was 14 μg/L; the maximum Tc-99 concentration was 10 pCi/L.

Sediment samples are also collected at the same locations where USEC surface water samples are collected, and at the NPDES outfalls on the east and west sides of the Portsmouth site (DOE 2002d). In 2001, the maximum uranium concentration in sediment was 5.6 μg/g, at background sampling location RM-10W. The maximum Tc-99 concentration was 16 pCi/g, at location RM-7 downstream on Little Beaver Creek. Several inorganic substances and PCBs were also monitored; results of the monitoring indicate no major difference between upstream and downstream concentrations. PCBs were not detected in sediments.

3.1.5.2 Groundwater

Five hydrogeological units are important for groundwater flow and contaminant migration beneath Portsmouth. These units are, in descending order, Minford Clay, Gallia Sand, Sunbury Shale, Berea Sandstone, and Bedford Shale. The upper two units form an aquifer in unconsolidated Quaternary deposits; the lower three units form a Mississippian bedrock aquifer. At the site, the hydraulic conductivities of all of the units are very low (Geraghty & Miller, Inc. 1989a). The most conductive unit is Gallia Sand. It has a mean hydraulic conductivity of 3.4 ft/d (1 m/d) and a range of 0.11 to 150 ft/d (0.03 to 46 m/d). It acts as the principal conduit for contaminant transport. The next most permeable unit is Berea Sandstone. It has a mean hydraulic conductivity of 0.16 ft/d (0.05 m/d) and a range of 0.0045 to 15 ft/d (0.0013 to 4.6 m/d). The average conductivity of Minford Clay, the shallowest unit, is estimated to be 0.00023 ft/d (7.0×10^{-5}) in the upper zone, while the conductivity of the lower zone is about 0.0042 ft/d (0.0013 m/d).

Within the upper portion of the bedrock aquifer, permeability is primarily produced by fractures. As depth increases, the presence of fractures decreases, and permeability depends more on porosity, grain size and shape, and packing arrangement (MMES 1993). At greater depth, the Berea Sandstone is probably more permeable than the shale units, which act as confining layers. The direction of groundwater flow beneath the site is controlled by a complex interaction between the Gallia and Berea units (Geraghty & Miller, Inc. 1989a). The flow patterns are also affected by the presence of storm sewer drains and by the reduction in recharge caused by the presence of buildings and paved areas. Groundwater flow patterns in both the Gallia and Berea units are characterized by an east-west-trending groundwater divide. The direction of groundwater flow is generally to the south in the southern sections of the Portsmouth site and to the north in the northern sections.

In the vertical direction, almost all wells exhibit a downward gradient from the Gallia to the Berea unit. The extent of the gradient is influenced by the thickness of the Sunbury Shale. Where the Sunbury Shale is thick, the gradient is large. In places where the Sunbury Shale is absent, upward vertical gradients are observed. Three main discharge areas exist for the groundwater system beneath Portsmouth: Little Beaver Creek to the north and east, Big Run Creek to the south, and two unnamed drainages to the west (Geraghty & Miller, Inc. 1989a).

Although Portsmouth has the ability to use Scioto River water, all water is currently supplied by three off-site water supply well fields completed in the Scioto River alluvium located just east of the Scioto River. Recharge of the aquifers is from river and stream flow as well as precipitation (annual average rainfall is 40.7 in. [103 cm]). In 2001, total groundwater production from this system averaged 6.6 million gal/d (2.5 million L/d) for the site, including USEC activities (DOE 2002d).

On-site groundwater at and around the Portsmouth site is monitored for radioactive and nonradioactive constituents at more than 400 wells. On site, five areas of groundwater contamination have been identified that contain contaminants. The main contaminants are VOCs (mostly trichloroethylene [TCE]) and radionuclides (e.g., uranium, Tc-99) (DOE 2002d).

Data from the 2000 annual groundwater monitoring showed that five contaminants exceeded their primary drinking water standards at the Portsmouth site: beryllium, chloroethane, americium, TCE, and uranium. Alpha and beta activity also exceeded the standards (DOE 2001d,e). The concentration of contaminants and the lateral extent of the plume did not significantly increase in 2001 (DOE 2002d).

Two phytoremediation projects to clean up TCE-contaminated groundwater are currently underway at the Portsmouth site. The phytoremediation projects involve the planting of hybrid poplar trees about 5 ft (2 m) apart in areas of contamination. The tree roots take up 50 to 350 gal (190 to 1,325 L) of water per day per tree and also provide nutrients to the soil, which accelerates bacterial breakdown of contaminants in the soil. One phytoremediation project, which started in 1999, is located on a small area of about 3 acres (1 ha) that is just northeast of Location A and borders part of the proposed new cylinder storage yard Area 2. The other project, started in 2001, is located on about 28 acres (11 ha) at the southern end of the Portsmouth site, to the south and southeast of Location B.

3.1.6 Biotic Resources

3.1.6.1 Vegetation

The most common type of vegetation on the Portsmouth site is managed grassland, which makes up 30% of the site (about 1,100 acres [445 ha]) (DOE 2001c). Grasses are the dominant species in these communities, and they are maintained by periodic mowing. Oak-hickory forest (covering 17% of the site) occurs on well-drained upland areas, and old-field communities (11%) occur in disturbed areas. Upland mixed hardwood forest also covers 11% of the site (400 acres [162 ha]). Black walnut, black locust, honey locust, black cherry, and persimmon are the dominant species in these mesic to dry upland communities. Riparian forest occurs in low, periodically flooded areas near streams; it makes up 4% of the site (153 acres [62 ha]). The dominant species in riparian forest communities are cottonwood, sycamore, willows, silver maple, and black walnut. Within the area surrounded by Perimeter Road, the Portsmouth site consists primarily of open grassland (including areas maintained as lawns) and developed areas consisting of buildings, paved areas, and storage yards.

Location A is approximately 26 acres (11 ha) in size and includes previously disturbed as well as undisturbed areas. Except for the northern portion, Location A is relatively level and has been graded. The northeastern portion of Location A and the area directly north of Building X-744-T support an old-field habitat, composed primarily of grasses such as fescue and broom-sedge, with crown vetch, wild carrot, and small scattered trees and shrubs. A drainage ditch bordering an old railroad bed in the east area supports sapling sycamore and black locust trees as well as mature black locust. Vegetation near the buildings is a managed grassland community and includes fescue, ox-eye daisy, and hop clover. Bulrush occurs in shallow drainage ditches. The area immediately adjacent to the buildings is infrequently mowed. At the northern boundary of Location A, the land surface slopes down to a small stream that runs along the northern margin of the location, approximately 100 ft (30 m) from the location boundary. This stream is bordered by a riparian woodland community of willow, mature sycamore, black locust, and maple. This woodland community is classified as riparian forest; however, the tree canopy is fairly open and narrow (less than 100 ft [30 m]) in width. Small woodland areas lie north of Building X-744-U and northwest of Building X-744-T; they are continuous with the riparian woodland community bordering the stream to the north. These wooded areas are composed primarily of mature black locust trees, along with honeysuckle, sumac, and sweet clover.

Location B is approximately 50 acres (20 ha) in size. It has been disturbed by grading and construction activities and has a level ground surface. The vegetation at this location is composed entirely of a managed grassland community and generally remains unmowed. The dominant species are fescue, broom-sedge, hop clover, and birdfoot trefoil.

Location C is approximately 78 acres (32 ha) in size and has been disturbed by grading activities. This location is relatively level to gently sloping throughout and supports an open, managed grassland vegetation community that generally remains unmowed. The dominant species is fescue, with yarrow and ox-eye daisy. Two drainages in the southwest portion of this location are bordered by narrow deciduous woodland communities (approximately 60 ft [18 m] in width) with open tree canopies. These woodland communities are classified as upland mixed hardwood forest community.

3.1.6.2 Wildlife

Habitats on the Portsmouth site support a relatively high diversity of terrestrial and aquatic wildlife species. Species observed on the site include 27 mammal species, 114 bird species, 11 reptile species, and 6 amphibian species. Ground-nesting species include bobwhite and eastern box turtle. Various species of reptiles and amphibians are associated with streams and other surface water on the site. Migrating waterfowl use site retention ponds (ANL 1991b). Additional information on wildlife resources is available in DOE (2001c), MMES (1993), and ANL (1991b).

Fish communities in Little Beaver Creek range from good to exceptional downstream of the Portsmouth outfall, and are fair upstream (OEPA 1998). Aquatic habitat quality in Little Beaver Creek is lower upstream of the Portsmouth outfall, where stream flow is intermittent. Upstream macroinvertebrate communities are poor, while downstream communities range from poor to exceptional. The fish community in West Ditch, which is downstream of Location A is marginally good, while the macroinvertebrate community is fair (OEPA 1993).

The habitats within Locations A, B, and C support wildlife species typical of similar habitats in the vicinity. Species occurring in open grassland areas like those that are common in the three locations include eastern cottontail, meadow vole, and eastern meadowlark. Small wooded areas, such as those at Locations A and B, support numerous woodland and forest edge species such as raccoon, gray squirrel, red-headed woodpecker, cardinal, white-breasted nuthatch, and yellow-rumped warbler.

3.1.6.3 Wetlands

A wetland survey of the Portsmouth site was conducted in 1995. Approximately 34 acres (14 ha) of wetlands occur on the site, excluding retention ponds. Forty-one wetlands meet the criteria for jurisdictional wetlands, while four wetlands are nonjurisdictional (Chandler 1996). Wetlands on the site primarily support emergent vegetation that includes cattail, great bulrush, and rush. Palustrine forested wetlands occur on the site along Little Beaver Creek (ANL 1991b). The Ohio State Division of Natural Areas and Preserves has listed two wetland areas near the site as significant wetland communities: (1) a palustrine forested wetland, about 5 mi (8 km) east of the site, and (2) Givens Marsh, a palustrine wetland with persistent emergent vegetation, about 2.5 mi (4 km) northeast of the site. The 100-year floodplains in the vicinity of the Portsmouth site include Big Beaver Creek and Little Beaver Creek. Both of these floodplains lie outside the area surrounded by Perimeter Road.

The drainage channel in the east portion of Location A supports a palustrine emergent wetland community of fox sedge, green bulrush, drooping bulrush, narrow-leaf cattail, and rush that is 0.08 acre (0.03 ha) in size; however, only 0.05 acre (0.02 ha) of this wetland lies within the boundary of Location A (Figure 3.1-5). The steep slopes of the channel are vegetated with upland species. The drainage channel conveys surface water runoff to an intermittent stream that borders the north margin of Location A and likely also receives groundwater discharge. The stream, which lies in a low floodplain, supports a riparian woodland community of willow, maple, sycamore, and black locust. The stream and adjacent riparian area lie outside the boundary of Location A. Another small stream originates near the southwest corner of this location and enters a small holding pond west of Perimeter Road, a short distance above the confluence with the northern stream.

Wetlands do not occur at Location B. However, a number of wetlands occur in the vicinity of Location B in areas previously disturbed by industrial development. These wetlands receive surface runoff from the surrounding landscape; also, as a result of previous grading activities, soils are poorly drained. A large palustrine emergent wetland (3.2 acres [1.3 ha]), composed primarily of cattails, lies immediately to the south of the east portion of the area; it receives runoff from portions of Location B. Another small wetland (0.3 acre [0.12 ha]) lies just outside the southeast corner boundary of Location B. Several additional wetland areas are located within the open area to the south of Location B. Streams receiving drainage from Location B lie to the south and southwest and support riparian forest communities. Drainage flows into a holding pond southwest of Perimeter Road.

Although no wetlands are identified at Location C, two small drainages in the southwest portion of the area direct surface water flows from Location C to Big Run Creek. The upper segment of the X-230K holding pond is located downstream, immediately west of this location. Also, a drainage ditch along the south margin of the parking area in the northwest portion of Location C directs surface flows into a small wetland area to the west, beyond the location boundary. Finally, a drainage ditch exiting this wetland joins the upper segment of the holding pond.

3.1.6.4 Threatened and Endangered Species

Federal- and state-listed species in the vicinity of the Portsmouth site are listed in Table 3.1-4. No occurrence of federal-listed plant or animal species on the Portsmouth site has been documented. The Indiana bat, both federal- and state-listed as endangered, has been reported in the vicinity of the Portsmouth site and may occur on the site during spring or summer; however, no Indiana bats were collected during surveys in 1994 and 1996 (DOE 1997c). Roosting and nursery sites may include forested areas with loose barked trees (such as shagbark hickory) and standing dead trees. Potential summer habitat for the Indiana bat was identified within the corridors along Little Beaver Creek, the Northwest Tributary stream, and a wooded area east of the X-100 facility. However, most of the Portsmouth site was found to have poor summer habitat because of the small size, isolation, and insufficient maturity of the few woodlands on the site.

The sharp-shinned hawk, listed by the State of Ohio as endangered, and the rough green snake, a species of special interest in Ohio, have been observed on the Portsmouth site (DOE 2001c). Both of these species inhabit moist woods. The timber rattlesnake, listed by the State of Ohio as endangered, occurs in the vicinity of the Portsmouth site but has not been found on the site. Habitat for the timber rattlesnake is found on and near high, dry ridges. Two state-protected plant species that occur on the Portsmouth site are Carolina yellow-eyed grass, listed as endangered, and Virginia meadow-beauty, listed as potentially threatened (DOE 2001c).

TABLE 3.1-4 Federal- and State-Listed Endangered, Potentially Threatened, and Special Concern Species near the Portsmouth Site

Category and Scientific Name	Common Name	Status[a] Federal	State
Mammals			
Myotis sodalis	Indiana bat	E	E
Birds			
Accipiter striatus	Sharp-shinned hawk		E
Reptiles			
Crotalus horridus	Timber rattlesnake		E
Opheodrys aestivus	Rough green snake		S
Plants			
Rhexia virginica	Virginia meadow-beauty		P
Xyris difformis	Carolina yellow-eyed grass		E

[a] E = endangered; P = potentially threatened; S = special concern.

Source: DOE (2001c).

These species occur in Quadrant IV, northeast of the area bounded by Perimeter Road. A population of long-beaked arrowhead, a wetland plant listed by the state as threatened, occurs just north of the site.

No federal- or state-listed species have been found to occur at Location A, B, or C. These locations do not support suitable habitat for the Indiana bat. Although Locations A and C contain small wooded areas, the proximity to paved roads and the small size and insufficient maturity of these areas would probably provide poor habitat for Indiana bats. These characteristics also limit the habitat suitability of these small wooded areas for the sharp-shinned hawk and rough green snake. Habitat for the timber rattlesnake does not occur on or near any of the three locations. The nearest populations of Carolina yellow-eyed grass and Virginia meadow-beauty are approximately 1.5 mi (2.4 km) north of Location A. The highly disturbed conditions at the three locations do not provide suitable habitat for these species.

3.1.7 Public and Occupational Safety and Health

3.1.7.1 Radiation Environment

Operations at the Portsmouth site result in radiation exposures of on-site workers and members of the off-site general public (Table 3.1-5). The maximum radiation dose to an off-site member of the public as a result of on-site facility operations is estimated to be 2.0 mrem/yr, which is less than 3% of the average dose of 78 mrem/yr from natural background radiation around the Portsmouth site (DOE 2002d). The DOE dose limit for the general public is 100 mrem/yr (DOE 1990). The maximum dose was estimated by using the largest environmental media concentrations monitored at different off-site locations, emission data, and conservative exposure parameters. In reality, the actual dose received by the general public would be much lower than the maximum value estimated.

Radiation exposures of the cylinder yard workers include exposures from activities performed outside the cylinder yards. The average dose in 2001 was 64 mrem/yr, obtained from monitoring data (DOE 2002d). That dose is considerably below the maximum dose limit of 5,000 mrem/yr set for radiation workers (10 CFR Part 835). The average dose in 2001 for all monitored DOE/Portsmouth employees and subcontractors was 1.85 mrem/yr.

3.1.7.2 Chemical Environment

Estimated hazard quotients for members of the general public under existing environmental conditions near the Portsmouth site are presented in Table 3.1-6. The hazard quotient represents a comparison of estimated maximum potential human intake levels with intake levels below which adverse effects are very unlikely to occur (see Appendix F for further details). The estimated hazard quotients indicate that exposures to uranium and fluoride for members of the general public near the Portsmouth site are much lower than those that might be associated with adverse health effects.

The Occupational Safety and Health Administration (OSHA) has proposed permissible exposure limits (PELs) for uranium compounds and HF in the workplace (29 CFR Part 1910, Subpart Z, as of February 2003) as follows: 0.05 mg/m^3 for soluble uranium compounds, 0.25 mg/m^3 for insoluble uranium compounds, and 2.5 mg/m^3 for HF. Portsmouth worker exposures are kept below those limits.

3.1.8 Socioeconomics

Socioeconomic data for the Portsmouth site focus on an ROI of four counties in Ohio: Jackson, Pike, Ross, and Scioto. The counties included in the ROI were selected on the basis of the current residential locations of government workers directly connected to Portsmouth activities. It encompasses the area in which these workers spend most of their salaries. More than 90% of Portsmouth workers currently reside in these counties (Takacs 2002). In the following sections, data are presented for each of the counties in the ROI. However, because the majority of Portsmouth workers live in Scioto and Pike Counties and in the City of Portsmouth, it is expected that the majority of impacts from Portsmouth activities would occur in these locations. Therefore, more emphasis is placed on these areas.

3.1.8.1 Population

The population of the ROI in 2000 was 212,876 people (U.S. Bureau of the Census 2002a) and was projected to reach 215,700 by 2003 (Table 3.1-7). In 2000, 79,195 people (37% of the ROI total) resided in Scioto County, with 20,909 of them residing in the City of Portsmouth itself (U.S. Bureau of the Census 2002a). During the 1990s, with the exception of Scioto County, each of the counties in the ROI experienced a small increase in population, with an ROI average increase of 0.4%, while Portsmouth itself experienced a decline of –0.8%. Over the same period, the population of Ohio grew at a rate of 0.5%.

3.1.8.2 Employment

Total employment in Scioto County was 18,691 in 2000 and was projected to reach 19,200 by 2003. The economy of the county is dominated by the trade and service sectors; employment in these sectors currently contributes more than 73% of all employment in the county (see Table 3.1-8). Employment growth in the highest growth sector, services, was 5.7% during the 1990s, compared with 1.0% in the county for all sectors as a whole (U.S. Bureau of the Census 1992, 2002b).

In 2000, total employment in Pike County was 10,739, and it was expected to reach 12,400 by 2003. The economy of the county is dominated by the manufacturing and service industries; employment in these activities currently contributes more than 78% of all employment in the county (see Table 3.1-9). Employment growth in the highest growth sector (services) was 9.5% during the 1990s, compared with 4.8% in the county for all sectors as a whole (U.S. Bureau of the Census 1992, 2002b).

TABLE 3.1-7 Population in the Portsmouth Region of Influence and Ohio in 1990, 2000, and 2003

Location	1990	2000	Growth Rate (%), 1990–2000[a]	2003[b] (Projected)
City of Portsmouth	22,676	20,909	-0.8	20,400
Scioto County	80,327	79,195	-0.1	78,900
Pike County	24,249	27,695	1.3	28,800
Jackson County	30,230	32,641	0.8	33,400
Ross County	69,330	73,345	0.6	74,600
ROI total	204,136	212,876	0.4	215,700
Ohio	10,847,115	11,353,140	0.5	11,510,000

[a] Average annual rate.

[b] ANL projections, as detailed in Appendix F.

Source: U.S. Bureau of the Census (2002a), except as noted.

TABLE 3.1-8 Employment in Scioto County by Industry in 1990 and 2000

Sector	No. of People Employed in 1990[a]	Percentage of County Total	No. of People Employed in 2000[b]	Percentage of County Total	Growth Rate (%), 1990–2000
Agriculture	921[c]	5.4	567[d]	3.0	-4.7[e]
Mining	50	0.3	10	0.1	-14.9
Construction	795	4.7	1,159	6.2	3.8
Manufacturing	2,237	13.2	2,257	12.1	0.1
Transportation and public utilities	664	3.9	316	1.7	-7.2
Trade	6,039	35.5	4,168	22.3	-3.6
Finance, insurance, and real estate	772	4.5	825	4.4	0.7
Services	5,455	32.1	9,498	50.8	5.7
Total	16,991		18,691		1.0

[a] U.S. Bureau of the Census (1992).

[b] U.S. Bureau of the Census (2002b).

[c] These agricultural data are from 1992 and are taken from U.S. Department of Agriculture (USDA) (1994).

[d] These agricultural data are from 1999 and are taken from USDA (1999).

[e] Agricultural data are for 1992 and 1997.

TABLE 3.1-9 Employment in Pike County by Industry in 1990 and 2000

Sector	No. of People Employed in 1990[a]	Percentage of County Total	No. of People Employed in 2000[b]	Percentage of County Total	Growth Rate (%), 1990–2000
Agriculture	206[c]	3.1	167[d]	1.6	-2.1[e]
Mining	60	0.9	76	0.7	2.4
Construction	183	2.7	342	3.2	6.5
Manufacturing	3,601	53.4	5,874	54.7	5.0
Transportation and public utilities	182	2.7	164	1.5	-1.0
Trade	1,269	18.8	1,361	12.7	0.7
Finance, insurance, and real estate	187	2.8	265	2.5	3.6
Services	1,018	15.1	2,517	23.4	9.5
Total	6,738		10,739		4.8

[a] U.S. Bureau of the Census (1992).

[b] U.S. Bureau of the Census (2002b).

[c] These agricultural data are from 1992 and are taken from USDA (1994).

[d] These agricultural data are from 1999 and are taken from USDA (1999).

[e] Agricultural data are for 1992 and 1997.

In 2000, total employment in the ROI was 63,044, and it was projected to reach 67,900 by 2003. The economy of the ROI is dominated by the manufacturing and service industries; employment in these activities currently contributes more than 66% of all employment in the ROI (see Table 3.1-10). Employment growth in the highest growth sector (services) was almost 6.6% during the 1990s, compared with 2.5% in the ROI for all sectors as a whole (U.S. Bureau of the Census 1992, 2002b). Employment at the Portsmouth site currently stands at 1,727 (Takacs 2002).

Unemployment in the ROI has remained persistently high despite falling rates during the 1990s. In Scioto County, the rate steadily declined during the 1990s from a peak rate of 11.5% in 1992 to the December 2002 rate of 7.3% (Table 3.1-11) (Bureau of Labor Statistics [BLS] 2002). In Pike County, rates also fell, from a peak of 11.7% in 1992 to the current rate of 8.9%. The December 2002 unemployment in the ROI was 7.2% compared with 5.0% for the state.

3.1.8.3 Personal Income

Personal income in Scioto County was about $1.6 billion in 2000 (in 2002 dollars), and it was projected to reach almost $1.9 billion by 2003, with an annual average rate of growth of 1.5% over the period 1990 through 2000 (Table 3.1-12). County per capita income also rose in the 1990s, and it was projected to reach $23,600 in 2003, compared with $17,631 at the beginning of the period.

TABLE 3.1-10 Employment in the Portsmouth Region of Influence by Industry in 1990 and 2000

Sector	No. of People Employed in 1990[a]	Percentage of ROI Total	No. of People Employed in 2000[b]	Percentage of ROI Total	Growth Rate (%), 1990–2000
Agriculture	2,568[c]	5.2	2,121[d]	3.4	-1.9[e]
Mining	274	0.6	299	0.5	0.9
Construction	1,922	3.9	2,671	4.2	3.4
Manufacturing	12,955	26.3	16,515	26.2	2.5
Transportation and public utilities	1,818	3.7	1,293	2.1	-3.6
Trade	14,388	29.2	11,689	18.5	-2.1
Finance, insurance, and real estate	1,813	3.7	3,308	5.2	6.2
Services	13,388	27.2	25,334	40.2	6.6
Total	49,254		63,044		2.5

[a] U.S. Bureau of the Census (1992).

[b] U.S. Bureau of the Census (2002b).

[c] These agricultural data are from 1992 and are taken from USDA (1994).

[d] These agricultural data are from 1999 and are taken from USDA (1999).

[e] Agricultural data are for 1992 and 1997.

In Pike County, personal income totaled almost \$0.6 billion in 2000 (in 2002 dollars), and it was projected to reach almost \$0.7 billion in 2003, with an annual average rate of growth of 3.4% over the period 1990 through 2000 (Table 3.1-12). County per capita income also rose in the 1990s, and it was projected to reach \$23,700 in 2003, compared with \$16,944 at the beginning of the period.

Growth rates in total personal income were higher in the ROI as a whole than for Scioto County, but lower than those for Pike County. Total personal income grew at a rate of 2.2% in the ROI over the period 1990 through 2000, and it was projected to reach \$5.3 billion by 2003. ROI per capita income was projected to grow from \$18,109 in 1990 to \$24,500 in 2003, an average annual growth rate of 1.8%.

TABLE 3.1-11 Unemployment Rates in Scioto and Pike Counties, the Portsmouth Region of Influence, and Ohio

Location and Period	Rate (%)
Scioto County	
1992–2002 average	9.4
Dec. 2002 (current rate)	7.3
Pike County	
1992–2002 average	9.5
Dec. 2002 (current rate)	8.9
ROI	
1992–2002 average	8.0
Dec. 2002 (current rate)	7.2
Ohio	
1992–2002 average	5.1
Dec. 2002 (current rate)	5.0

Source: BLS (2002).

TABLE 3.1-12 Personal Income in Scioto and Pike Counties and the Portsmouth Region of Influence in 1990, 2000, and 2003

Location and Type of Income	1990	2000	Growth Rate (%), 1990–2000	2003 (Projected)[a]
Scioto County				
Total personal income (millions of 2002 $)	1,416	1,624	1.5	1,900
Personal per capita income (2002 $)	17,631	20,501	1.7	23,600
Pike County				
Total personal income (millions of 2002 $)	411	556	3.4	690
Personal per capita income (2002 $)	16,944	20,061	1.9	23,700
Total ROI				
Total personal income (millions of 2002 $)	3,697	4,509	2.2	5,300
Personal per capita income (2002 $)	18,109	21,180	1.8	24,500

[a] ANL projections, as detailed in Appendix F.

Source: U.S. Department of Commerce (2002).

3.1.8.4 Housing

Housing stock in Scioto County grew at an annual rate of 0.5% over the period 1990 through 2000 (Table 3.1-13) (U.S. Bureau of the Census 2002a), with total housing units projected to remain at 34,600 by 2003, reflecting the declining growth in county population. Housing in the City of Portsmouth declined during this period by –0.5%, with total housing units expected to fall to 10,100 in 2003. About 1,600 new units were added to the existing housing stock in the county during the 1990s, but there were 500 fewer units in the City of Portsmouth in 2000. Vacancy rates in 2000 stood at 11.0% in the city and 9.3% in the county as a whole for all types of housing. On the basis of annual population growth rates, 3,400 vacant housing units were expected in the county in 2003, of which about 1,000 were expected to be rental units available to incoming construction workers at the proposed facility.

TABLE 3.1-13 Housing Characteristics in the City of Portsmouth, Scioto and Pike Counties, and the Region of Influence in 1990 and 2000

Location and Type of Unit	No. of Units 1990	No. of Units 2000
City of Portsmouth		
Owner-occupied	5,478	4,853
Rental	4,189	4,267
Total unoccupied	1,091	1,128
Total	10,758	10,248
Scioto County		
Owner-occupied	20,774	21,646
Rental	9,012	9,225
Total unoccupied	2,622	3,183
Total	32,408	34,054
Pike County		
Owner-occupied	6,113	7,314
Rental	2,692	3,130
Total unoccupied	917	1,158
Total	9,722	11,602
ROI Total		
Owner-occupied	52,302	58,246
Rental	21,874	22,824
Total unoccupied	6,579	7,956
Total	80,755	89,026

Source: U.S. Bureau of the Census (2002a).

Housing stock in Pike County grew at an annual rate of 1.8% over the period 1990 through 2000 (Table 3.1-13) (U.S. Bureau of the Census 2002b), with total housing units expected to reach 12,200 in 2003, reflecting moderate growth in county population. Almost 1,900 new units were added to the existing housing stock in the county during the 1990s. Vacancy rates in 2000 stood at 10% in the county as a whole for all types of housing. On the basis of annual population growth rates, 1,200 vacant housing units were projected in the county in 2003. About 360 of these were expected to be rental units available to incoming construction workers.

In the ROI as a whole, housing grew at a faster rate than in Scioto County or the City of Portsmouth during the 1990s, with an overall growth rate of 1.0%. Total housing units were expected to reach 91,700 by 2003, with more than 8,300 housing units added in the 1990s. On the basis of vacancy rates in 2000, which stood at 8.9%, more than 2,300 rental units were expected to be available to incoming construction workers.

3.1.8.5 Community Resources

3.1.8.5.1 Community Fiscal Conditions. Revenues and expenditures for local government jurisdictions, including counties, cities, and school districts, constitute community fiscal conditions. Revenues would come primarily from state and local sales tax revenues associated with employee spending during construction and operation and would be used to support additional local community services currently provided by each jurisdiction. Tables 1 and 2 in Allison (2002) present information on revenues and expenditures by the various local government jurisdictions in the ROI.

3.1.8.5.2 Community Public Services. Construction and operation of the proposed facility would increase demand for community services in the counties, cities, and school districts likely to host relocating construction workers and operations employees. Additional demands would also be placed on local medical facilities and physician services. Tables 3.1-14 and 3.1-15 present data on employment and levels of service (number of employees per 1,000 population) for public safety, general local government services, and physicians. Tables 3.1.8-16 and 3.1.8-17 provide staffing data for school districts and hospitals.

3.1.9 Waste Management

The Portsmouth site generates several categories of waste, including wastewater; solid LLW; solid and liquid mixed hazardous and radiological waste; nonradioactive hazardous waste;

TABLE 3.1-14 Public Service Employment in the City of Portsmouth, Scioto and Pike Counties, and Ohio in 2002

	City of Portsmouth		Scioto County		Pike County		Ohio[b]
Employment Category	No. of Workers	Level of Service[a]	No. of Workers	Level of Service[a]	No. of Workers	Level of Service[a]	Level of Service[a]
Police	44	2.1	90	1.5	10	0.4	2.3
Fire[c]	44	2.1	0	0	0	0	1.4
General	212	10.1	730	12.5	294	12.6	34.6
Total	300	14.3	820	14.1	304	13.1	52.4

[a] Level of service represents the number of employees per 1,000 persons in each jurisdiction (U.S. Bureau of the Census 2002a).

[b] 2000 data.

[c] Does not include volunteers.

Sources: City of Portsmouth: Doyle (2002); Scioto County: Massey (2002); Pike County: Jones (2002); Ohio: U.S. Bureau of the Census (2002c).

TABLE 3.1-15 Number of Physicians in Scioto and Pike Counties and Ohio in 1997

Employment Category	Scioto County Number	Scioto County Level of Service[a]	Pike County Number	Pike County Level of Service[a]	Ohio Level of Service[a]
Physicians	106	1.3	25	0.9	2.4

[a] Level of service represents the number of physicians per 1,000 persons in each jurisdiction.

Source: American Medical Association (1999).

TABLE 3.1-16 School District Data for Scioto and Pike Counties and Ohio in 2001

Employment Category	Scioto County No.	Scioto County Student-to-Teacher Ratio[a]	Pike County No.	Pike County Student-to-Teacher Ratio[a]	Ohio Student-to-Teacher Ratio[a]
Teachers	732	17.9	287	19.0	10.8

[a] The number of students per teacher in each school district.

Source: Ohio Department of Education (2002).

TABLE 3.1-17 Medical Facility Data for Scioto and Pike Counties in 1998

Hospital	No. of Staffed Beds	Occupancy Rate (%)[a]
Scioto County		
Southern Ohio Medical Center	281	56
Pike County		
Pike Community Hospital	40	NA[b]

[a] Percentage of staffed beds occupied.

[b] NA = not available.

Source: Healthcare InfoSource, Inc. (1998).

and nonradioactive, nonhazardous solid waste. Disposal of waste generated from ongoing management of the DOE-generated DUF_6 cylinders currently in storage is managed by DOE. USEC is responsible for wastes generated from ongoing operations that are leased from DOE, except for "legacy wastes," which contain constituents such as asbestos and PCBs. The cylinder storage yards at Portsmouth currently generate only a very small amount of waste compared with the volume of waste generated from ongoing plant operations. Cylinder yard waste consists of small amounts of metal, scrapings from cylinder maintenance operations, potentially contaminated soil, and miscellaneous items.

The site has an active program to minimize the generation of solid LLW, hazardous waste, and LLMW. Radioactive waste minimization efforts include segregating radioactive waste from nonradioactive waste; reducing radiologically controlled areas, thereby reducing the volume of personal protective equipment; and improving the segregation and handling of laboratory waste. Hazardous and mixed waste minimization actions include sorting burnable waste from radioactively contaminated materials, reducing the use of absorbent cloths to clean up PCB spills, reducing floor sweeping waste, and substituting materials containing nonhazardous components. Solid waste minimization actions include recycling corrugated cardboard, office paper, fluorescent light bulbs, batteries, and aluminum.

Table 3.1-18 lists the Portsmouth site waste loads assumed for the analysis of impacts of projected activities.

TABLE 3.1-18 Projected Waste Generation Volumes for the Portsmouth Site[a]

Waste Category	Waste Treatment Volume (m^3/yr)
LLW	73,000
LLMW	5,600
TRU	0
Hazardous waste	110
Nonhazardous waste[b]	
Solids	3,200
Wastewater	145,000

[a] Volumes include operational and environmental restoration wastes projected from FY 2002 to FY 2025.

[b] Volumes include sanitary and industrial wastes.

Source: Cain (2002c).

3.1.9.1 Wastewater

Wastewater at Portsmouth consists of nonradioactive sanitary and process-related wastewater streams, cooling water blowdown, radioactive process-related liquid effluent, discharges from groundwater treatment systems, and storm water runoff from plant areas, including runoff from the coal pile. Wastewater is processed at several on-site treatment facilities and then discharged to either the Scioto River or its immediate tributaries, including Little Beaver Creek, through several permitted outfalls. Treatment facilities include an activated sludge sewage treatment plant; several facilities that employ waste-specific pretreatment technologies (e.g., pH adjustment, activated carbon adsorption, metals removal, denitrification, and ion absorption); and numerous settling basins designed to facilitate solids settling, oil collection, and chlorine dissipation. The site wastewater facilities have a capacity of approximately 5.3 million gal/d (20 million L/d) (DOE 1996a).

3.1.9.2 Solid Nonhazardous, Nonradioactive Waste

Solid waste — including sanitary refuse, cafeteria waste, industrial waste, disinfected medical waste (excluding drugs), and construction and demolition waste — is collected and disposed of off site at a state-permitted sanitary landfill. Disposal is in shallow trenches covered with earthen fill.

3.1.9.3 Nonradioactive Hazardous and Toxic Waste

Nonradioactive waste that is considered hazardous waste according to RCRA, or that contains PCBs defined under the Toxic Substances Control Act (TSCA), requires special handling, storage, and disposal. The Portsmouth site generates waste, including spent solvents, heavy-metal-contaminated waste, and PCB-contaminated toxic waste. Portsmouth provides long-term on-site storage for hazardous waste at the X-7725 and X-326 RCRA storage areas. Several additional 90-day satellite storage areas are available for temporary storage of hazardous waste. Hazardous waste is sent to permitted off-site contractors for final treatment and/or disposal.

3.1.9.4 Low-Level Radioactive Waste

LLW generated at the Portsmouth site is stored on site pending shipment to off-site treatment/disposal facilities. Solid LLW generated at the site includes refuse, sludge, and debris contaminated with radionuclides, primarily uranium and Tc-99.

3.1.9.5 Low-Level Radioactive Mixed Waste

LLW that contains PCBs or RCRA hazardous components is considered to be LLMW. All of the LLMW inventory at Portsmouth is subject to RCRA land disposal restrictions. LLMW is currently stored on site pending shipment to off-site disposal facilities.

3.1.10 Land Use

The Portsmouth site is located in south-central Ohio, in the southern portion of rural Pike County about 22 mi (35 km) north of the Ohio River and about 1 mi (1.6 km) east of the Scioto River. On the basis of an analysis of Landsat satellite imagery from 1992, dominant land cover categories in Pike County include deciduous forest (64.6%), pasture/hay (21.6%), and row crops (10.3%) (Figure 3.1-6). The 1997 agricultural census recorded 435 farms in Pike County in 1997, covering more than 78,300 acres (31,687 ha) (USDA 1999). Human settlement is sparse throughout most of Pike County; the largest communities (Piketon and Waverly) are located near the Scioto River north of the Portsmouth site. Apart from the two communities just mentioned and the villages of Jasper northwest of the site and Wakefield south of the site, the portion of Pike County containing the Portsmouth site is dominated by forest, pasture, and row crops.

The Portsmouth site covers 3,714 acres (1,500 ha); the uranium enrichment facilities are located on an 800-acre (320-ha) fenced core area within the larger site. The site is heavily developed and includes about 150 buildings, trailers, and sheds. The areas between structures consist primarily of mowed grassy areas and pasture, while the area immediately surrounding the Portsmouth site generally features a combination of deciduous forest and pasture.

3.1.11 Cultural Resources

Southern Ohio contains evidence from most of the major prehistoric periods for Eastern North America. The earliest period, Paleoindian, is very poorly represented in southern Ohio; however, numerous sites dating to the Archaic Period (9,000 B.C.–900 B.C.) have been found in close proximity to Portsmouth. The Woodland Period (900 B.C.–A.D. 900) is also well-represented, as evidenced by the mound complexes that appear in southern Ohio. The final prehistoric period represented in southern Ohio is the Fort Ancient culture (A.D. 900–A.D. 1600). During the early historic period, the Shawnee inhabited southern Ohio, including the Scioto Valley where Portsmouth is located. No federally recognized tribe has land claims in Pike County; however, the county is in the traditional range of the Shawnee Indians. Consultations with the Shawnee and the Ohio State Historic Preservation Officer (SHPO) have been initiated (see Appendix E for consultation letters). However, no religious or sacred sites, burial sites, or resources significant to Native Americans have been identified at the Portsmouth site to date.

The first permanent non-native settlement in the region was in 1801. The economy was almost entirely based on agriculture. The populations in the Portsmouth region grew slowly. The primary impetus for growth in the Scioto Valley was the expansion of transportation routes. During the 19th and early 20th centuries, several canals, roads, and, finally, railroads were constructed in the Scioto Valley region.

In 1951, the Scioto Valley was chosen by the AEC as the location for the third gaseous uranium diffusion facility within the nation's Cold War nuclear complex, to complement the facilities at Oak Ridge, Tennessee, and Paducah, Kentucky. Construction of the Portsmouth GDP began in 1952. The plant first became operational in 1954 and was completed in 1956. The facility provided enriched uranium-235 to fuel power reactors and nuclear-powered submarines and ships. The Portsmouth facility scaled back production for many years, suspending the production of highly enriched uranium in 1991, after the end of the Cold War.

Portsmouth and its surrounding area have the potential to yield both prehistoric and historic cultural resources. Archaeological and architectural surveys were undertaken at Portsmouth in 1996; however, neither report has been finalized. Discussions between Portsmouth and the Ohio SHPO are ongoing. The proposed construction sites at Portsmouth have been previously disturbed, and preservation of archaeological sites is unlikely. Cold War era structures do exist at Locations A and B, but their significance has yet to be determined.

3.1.12 Environmental Justice

3.1.12.1 Minority Populations

This EIS uses data from the most recent decennial census in 2000 to evaluate environmental justice implications of the proposed action and all alternatives with respect to minority populations. The CEQ guidelines on environmental justice recommend that "minority" be defined as members of American Indian or Alaska Native, Asian or Pacific Islander, Black non-Hispanic, and Hispanic populations (CEQ 1997). The earliest release of 2000 census data that included information necessary to identify minority populations identified individuals both according to race and Hispanic origin (U.S. Bureau of the Census 2001). It also identified individuals claiming multiple racial identities (up to six races). To remain consistent with the CEQ guidelines, the phrase "minority population" in this document refers to persons who identified themselves as partially or totally Black (including Black or Negro, African American, Afro-American, Black Puerto Rican, Jamaican, Nigerian, West Indian, or Haitian), American Indian or Alaska Native, Asian, Native Hawaiian or other Pacific Islander, or "Other Race." The minority category also includes White individuals of Hispanic origin, although the latter is technically an ethnic category. To avoid double counting, tabulations included only White Hispanics; the above racial groups already account for non-White Hispanics. In sum, then, the minority population considered under environmental justice consisted of all non-White persons (including those of multiple racial affiliations) plus White persons of Hispanic origin.

To identify census tracts with disproportionately high minority populations, this EIS uses the percentage of minorities in each state containing a given tract as a reference point. Using the individual states to identify disproportionality acknowledges that minority distributions in the state can differ from those found in the nation as a whole. In 2000, of the 206 census tracts within 50 mi (80 km) of the proposed conversion facility at Portsmouth, 12 had minority populations in excess of state-specified thresholds — a total of 7,735 minority persons in all (Figure 3.1-7). In Pike County, 3.7% of the 2000 population was minority (U.S. Bureau of the Census 2002d).

3.1.12.2 Low-Income Populations

As recommended by the CEQ guidelines, the environmental justice analysis identifies low-income populations as those falling below the statistical poverty level identified annually by the U.S. Bureau of the Census in its Series P-60 reports on income and poverty. The Census Bureau defines poverty levels on the basis of a statistical threshold that considers for each family both overall family size and the number of related children younger than 18 years old. For example, in 1999, the poverty threshold annual income for a family of three with one related child younger than 18 was $13,410, while the poverty threshold for a family of five with one related child younger than 18 was $21,024 (see U.S. Bureau of the Census 2000). The 2000 census used 1999 thresholds because 1999 was the most recent year for which annual income data were available when the census was conducted. If a family fell below the poverty line for its particular composition, the census considered all individuals in that family to be below the poverty line.

To identify census tracts with disproportionately high low-income populations, this EIS uses the percentage of low-income persons in each state containing a given tract as a reference point. In 1999, of the 206 census tracts within 50 mi (80 km) of the proposed conversion facility at Portsmouth, 142 had low-income populations in excess of state-specified thresholds — a total of 133,303 low-income persons in all (Figure 3.1-8). In Pike County, 18.6% of the individuals for whom poverty status was known in 1999 were low-income (U.S. Bureau of the Census 2002d).

3.2 EAST TENNESSEE TECHNOLOGY PARK

ETTP is located in eastern Roane County about 25 mi (40 km) west of Knoxville, Tennessee (Figure 3.2-1). ETTP is part of the ORR in the City of Oak Ridge, Tennessee. The site was established in 1940 with initiation of construction of the Oak Ridge Gaseous Diffusion Plant. Uranium enrichment was the site's mission until the mid-1980s, when gaseous diffusion operations ceased. In 1990, the site was renamed as the K-25 Site, and it was renamed again in 1997 as the ETTP. Previous missions were waste management and restoration; the current mission is to "reindustrialize and reuse site assets through leasing of vacated facilities and incorporation of commercial industrial organizations as partners in the ongoing environmental restoration, D&D, waste treatment and disposal, and diffusion technology development activities" (DOE 2001f).

3.2.1 Cylinder Yards

There are 4,822 DUF_6 storage cylinders located in ETTP site cylinder yards (Table 3.2-1; Figure 3.2-2). Cylinders are stacked two high to conserve space. About 30% of the cylinders are stored in yard K-1066-E (constructed with a concrete base), and 30% are stored in yard K-1066-K (constructed with a gravel base). The other cylinders are stored in four smaller yards.

TABLE 3.2-1 DOE-Managed DUF_6 Cylinders at the ETTP Site

Cylinder Type	No. of Cylinders
Full	4,719
Partially full	83
Heel	20
Total	4,822

Source: Hightower (2004).

In storage at ETTP, in addition to the cylinders that contain DUF_6, are a number of cylinders in various sizes that contain enriched UF_6 or normal UF_6 or are empty. The non-DUF_6 cylinders total 1,102 and contain a total of about 26 t (29 tons) of UF_6 (7 t [8 tons] of enriched UF_6 plus 19 t [21 tons] of normal UF_6) (Hightower 2004). About 20 cylinders are empty. Of the 881 non-DUF_6 cylinders that contain enriched uranium, fewer than 30 contain uranium enriched to greater than 5% uranium-235, and all of these are small, sample cylinders containing less than 3 lb (1.4 kg) of UF_6 each.

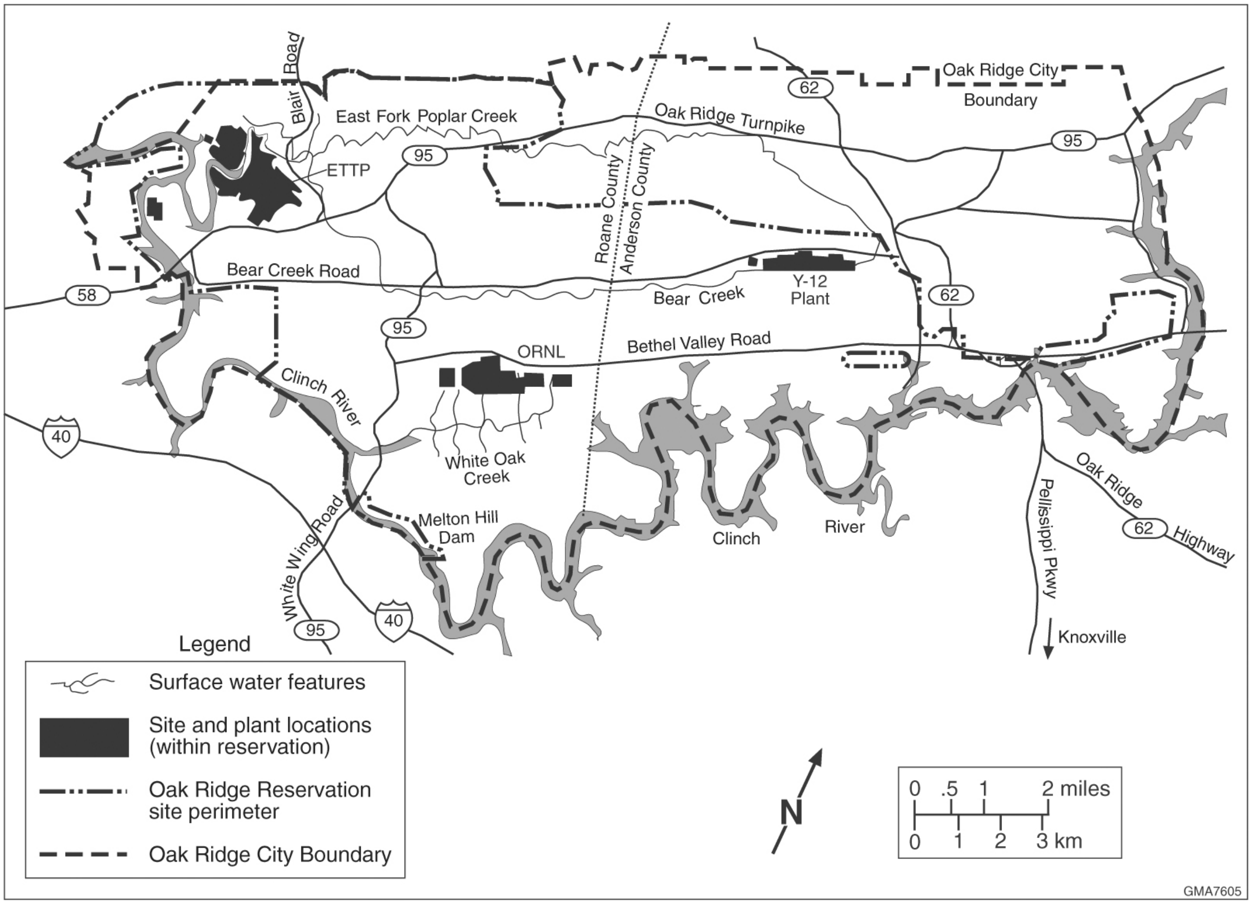

FIGURE 3.2-1 Regional Map of the ETTP Vicinity

Over 98% of the enriched UF_6 in cylinders at ETTP contains less than 5% uranium-235. It is assumed that the natural and enriched UF_6 would be put to beneficial uses; therefore, conversion of the contents of the non-DUF_6 cylinders is not considered in this EIS. This EIS does, however, include these cylinders in its evaluation of an alternative that considers the transportation of cylinders from ETTP to Portsmouth for conversion.

It is expected that many of the full DUF_6 cylinders at the ETTP site would not meet DOT transportation requirements because of damage and corrosion from poor historical storage conditions. It was estimated in the PEIS that a range of one-half to all of the full DUF_6 cylinders would not meet DOT transportation requirements (DOE 1999a). More recent estimates indicate that 1,700 cylinders are DOT compliant, with the remainder not meeting DOT requirements (see Section 1.7). No similar estimate of the condition of the non-DUF_6 cylinders at ETTP is available.

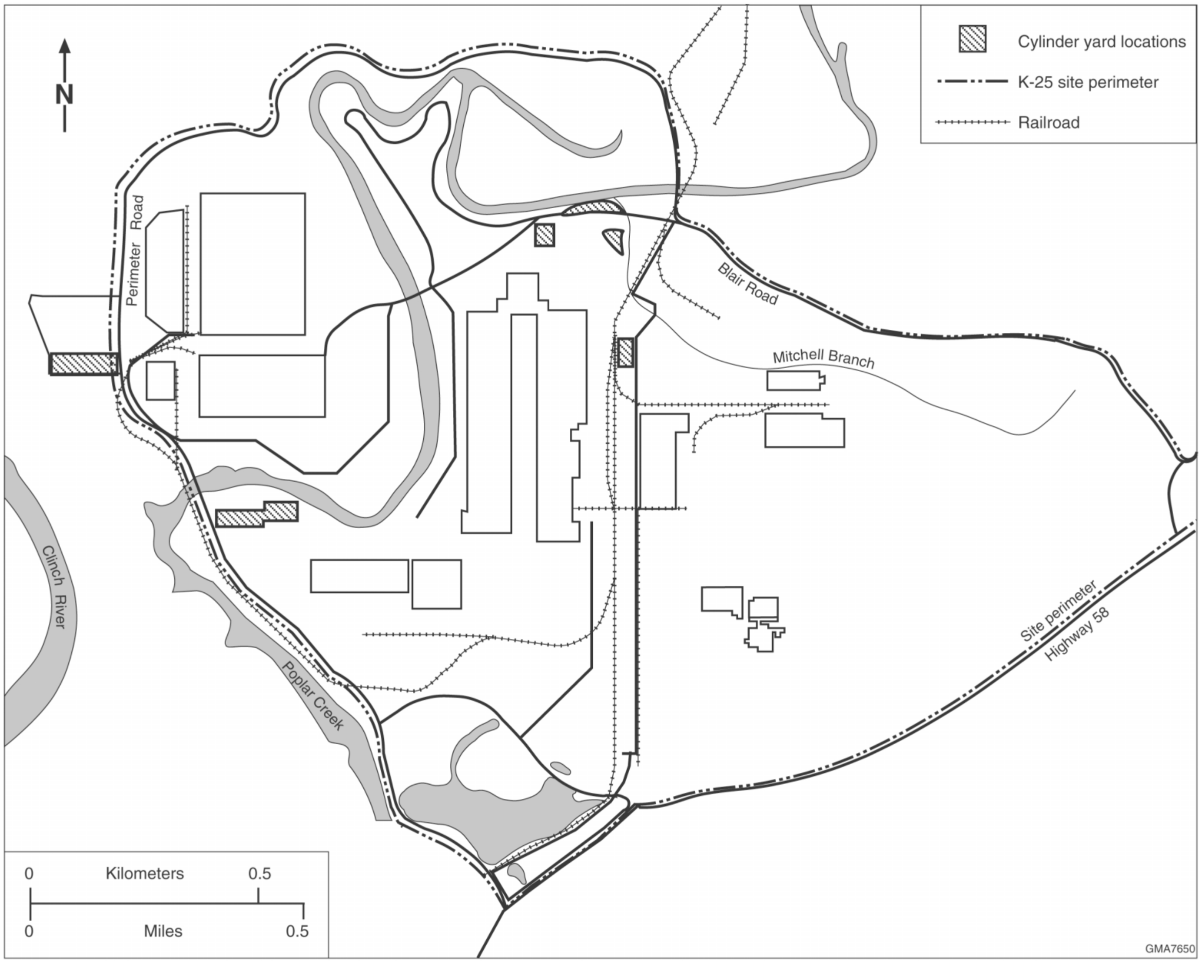

FIGURE 3.2-2 Locations of Storage Yards at ETTP That Are Used to Store DOE-Managed Cylinders

3.2.2 Site Infrastructure

The ETTP site is located in an area with a well-established transportation network. The site is near two interstate highways, several U.S. and state highways, two major rail lines, and a regional airport (Figure 3.2-1).

The ETTP water supply is pumped from Clinch River. The water is treated and stored in two storage tanks. This system, with a capacity of 4 million gal/d (15 million L/d), provides water to the Transportation Safeguards Facility and the ETTP site.

Electric power is supplied by the Tennessee Valley Authority (TVA). The distribution of power is managed through the ETTP Power Operations Department. The average demand for electricity by all of the DOE facilities at Oak Ridge, including the ETTP site, is approximately 100 MVA. The maximum capacity of the system is 920 MVA (DOE 1995). Natural gas is supplied by the East Tennessee Natural Gas Company; the daily capacity of 7,600 decatherms can be increased, if necessary. The average daily usage in 1994 was 3,600 decatherms (DOE 1995).

3.2.3 Climate, Air Quality, and Noise

3.2.3.1 Climate

The climate of the region, including the ETTP site, may be broadly classified as humid continental. The region is located in a broad valley between the Cumberland Mountains to the northwest and the Great Smoky Mountains to the southeast, which influence meteorological patterns over the region (Wood 1996). During the summer, tropical air masses from the south provide warm and humid conditions that often produce thunderstorms. In winter, the Cumberland Mountains have a moderating influence on local climate by shielding the region from cold air masses from the north and west.

For the 1961 through 1990 period, the annual average temperature was 13.7°C (56.6°F), with the highest monthly average temperature of 24.3°C (75.8°F) occurring in July and the lowest of 1.7°C (35.0°F) occurring in January (Wood 1996). Annual precipitation averages about 137 cm (53.8 in.), including about 25 cm (9.8 in.) of snowfall. Precipitation is evenly distributed throughout the season, with the highest occurring in spring.

Winds in the region are controlled in large part by the valley-and-ridge topography. Prevailing wind directions are from the northeast and southwest, reflecting the channeling of winds parallel to the ridges and valleys in the area. The average wind speed at Oak Ridge is about 2.0 m/s (4.4 mph); the dominant wind direction is from the southwest (Wood 1996). For 2001, the average wind speed at the 10-m (33-ft) level of the ETTP K1209 meteorological tower was 1.5 m/s (3.4 mph), as shown in Figure 3.2-3 (ORNL 2002). The dominant wind direction at the tower was southwest, with secondary peaks from the south-southwest and the east. These lower wind speeds at the ETTP tower and in the region reflect the air stagnation relatively common in eastern Tennessee.

Tornadoes rarely occur in the valley surrounding the ETTP site between the Cumberlands and the Great Smokies, and they historically have been less destructive than those in the Midwest. For the period 1950 through 1995, 541 tornadoes were reported in Tennessee, with an average of 12 tornadoes per year (Storm Prediction Center 2002). For the same period, 3 tornadoes were reported in Anderson and Roane Counties each, but these tornadoes were relatively weak, being F3 of the Fujita tornado scale, at most.

3.2.3.2 Existing Air Emissions

At the end of calendar year 2001, there were 88 active air emission sources under DOE control at ETTP (DOE 2002e). Of these 88 sources, ETTP operated 30; these were covered under eight major air emission sources subject to rules in the Tennessee Title V Major Source Operating Permit Program under an application shield granted by the TDEC Division of Air Pollution Control. All remaining active air emission sources are exempt from permitting requirements.

Major sources for criteria pollutants and VOCs in Anderson and Roane Counties in Tennessee include TVA steam plants and DOE operations, including the Y-12, ORNL, and ETTP sites. Annual emissions from major sources and total county emissions are presented in Table 3.2-2. The SO_2 and NO_x emissions from ETTP operations are negligible compared with those from the two TVA steam plants in Anderson and Roane Counties. However, VOC emissions account for about 39% of the Roane County emission total, and PM (PM_{10} and $PM_{2.5}$) emissions account for about 8% of the Roane County emission total. The amount of actual emissions from the ETTP site is much less than the amount of allowable emissions presented in Table 3.2-2 (DOE 2002e).

The State of Tennessee and the EPA regulate airborne emissions of radionuclides from DOE facilities under 40 CFR 61, Subpart H, NESHAPs regulations (DOE 2002e). The three ETTP major sources that operated during 2000 were the TSCA incinerator and two stacks in the K-33 building operated by British Nuclear Fuels, Ltd. Emissions from these exhaust stacks are controlled by a particulate filtration system, and continuous sampling for radionuclides emissions is conducted at these stacks to assess the dose to the public.

TABLE 3.2-2 Annual Criteria Pollutant and Volatile Organic Compound Emissions from Selected Major Point Sources around the ETTP Site in 1999

	Emission Rate (tons/yr)					
Major Emission Source	SO_2	NO_x	CO	VOC	PM_{10}	$PM_{2.5}$
TVA Bull Run Steam Plant, Clinton	38,179	13,528	420	50	529	267
Y-12 Plant (DOE)	13,375	1,672	38	19	61	21
Anderson County, Tenn., total	51,555	15,237	460	405	731	365
TVA Kingston Steam Plant, Kingston	109,194	26,055	995	122	95	98
ORNL (DOE)	361	25	53	14	363	267
ETTP (formerly K-25) (DOE)	222	60	29	86	41	34
	(0.20%, 0.14%)[a]	(0.23%, 0.14%)	(2.5%, 1.8%)	(39%, 14%)	(8.2%, 3.2%)	(8.5%, 4.5%)
Roane County, Tenn., total	109,777	26,149	1,157	222	498	399

[a] First and second values in parentheses are ETTP emissions as percentages of Roane County emissions total and combined Anderson and Roane Counties emissions total, respectively.

Source: EPA (2003b).

3.2.3.3 Air Quality

The Tennessee SAAQS for six criteria pollutants — SO_2, NO_2, CO, O_3, PM (PM_{10} and $PM_{2.5}$), and Pb — are almost the same as the NAAQS (Waynick 2002), as shown in Table 3.2-3. In addition, the state has adopted standards for gaseous fluorides (expressed as HF), as presented in Table 3.2-4.

The ETTP site in Roane County is located in the Eastern Tennessee-Southwestern Virginia Interstate AQCR. Currently, the county is designated as being in attainment for all criteria pollutants (40 CFR 81.343).

Although uranium enrichment activities at ETTP were discontinued in 1985, ambient air monitoring for radionuclides, criteria pollutants (PM_{10} and Pb),[3] and several metals has continued at on-site and off-site locations (DOE 2002e). Monitoring indicates that no standards were exceeded, and there was no statistically significant elevation of pollutant concentrations associated with site operations. On the basis of modeling radionuclide emissions from all major and minor point sources, the effective dose equivalent to the most exposed member of the public was 0.8 mrem/yr in 2001, well below the NESHAPs dose limit of 10 mrem/yr (DOE 2002e). Also, the airborne dose from all ETTP radionuclide emissions was still less than the ORR maximum. The highest concentration levels for SO_2, NO_2, CO, PM_{10}, 24-hour $PM_{2.5}$, and Pb around and within the ETTP site are less than or equal to 78% of their respective NAAQS in Table 3.2-3 (EPA 2003b; DOE 2002e). However, the highest O_3 and annual $PM_{2.5}$ concentrations that are of regional concern are approaching or somewhat higher than the applicable NAAQS.

PSD regulations (40 CFR 52.21) limit the maximum allowable incremental increases in ambient concentrations of SO_2, NO_2, and PM_{10} above established baseline levels, as shown in Table 3.2-3. The PSD regulations, which are designed to protect ambient air quality in Class I and Class II attainment areas, apply to major new sources and major modifications to existing sources. The nearest Class I PSD is the Great Smoky Mountains National Park, about 55 km (34 mi) southeast of ETTP. The Joyce Kilmer-Slickrock Wilderness Area just south of the western end of Great Smoky Mountains National Park is also a Class I area. These Class I areas are not located downwind of prevailing winds at ETTP (see Figure 3.2-3).

3.2.3.4 Existing Noise Environment

The Noise Control Act of 1972, along with its subsequent amendments (Quiet Communities Act of 1978, 42 USC Parts 4901–4918), delegates to the states the authority to regulate environmental noise and directs government agencies to comply with local community noise statutes and regulations. Anderson County has quantitative noise-limit regulations, as shown in Table 3.2-5 (Anderson County 2002), although the State of Tennessee and Roane County do not.

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[3] At the end of 2001, all PM_{10} sampling was discontinued after a review of PM_{10} data over a 10-year period (1991 through 2000) in which all concentrations were below the ambient air quality standards.

TABLE 3.2-4 Additional Tennessee Ambient Air Quality Standards[a]

Pollutant	Averaging Time	Primary Standard	Secondary Standard
Gaseous fluorides (as HF)	12 hours	–[b]	3.7 $\mu g/m^3$(4.5 ppb)[c]
	24 hours	–	2.9 $\mu g/m^3$ (3.5 ppb)[c]
	7 days	–	1.6 $\mu g/m^3$ (2.0 ppb)[c]
	30 days	–	1.2 $\mu g/m^3$ (1.5 ppb)[c]
Gaseous fluorides (as HF)[d]	30 days	–	0.5 $\mu g/m^3$ (0.6 ppb)[c]

[a] These standards are in addition to the Tennessee's SAAQS listed in Table 3.2-3.

[b] A dash indicates that no standard exists.

[c] This average is not to be exceeded more than once per year.

[d] Applied in the vicinity of primary aluminum reduction plants in operation on or before December 31, 1973.

Source: TDEC (1999).

TABLE 3.2-5 Allowable Noise Level by Zoning District in Anderson County, Tennessee

Zoning		Allowable Noise Level (dBA)	
District	Abbreviation	7 a.m.–10 p.m.	10 p.m.–7 a.m.
Suburban-residential	R-1	60	55
Rural-residential	A-2	65	60
Agriculture-forest	A-1	65	60
General commercial	C-1	70	65
Light industrial	I-1	70	70
Heavy industrial	I-2	80	80
Floodway	F-1	80	80

Source: Anderson County (2002).

The EPA has recommended a maximum noise level of 55 dB(A) as DNL to protect against outdoor activity interference and annoyance (EPA 1974a). This level is not a regulatory goal but is “intentionally conservative to protect the most sensitive portion of the American population” with “an additional margin of safety.” For protection against hearing loss in the general population from nonimpulsive noise, the EPA guideline recommends an L_{eq}(24 h) of 70 dB(A) or less over a 40-year period.

The noise-producing activities within the ETTP site are associated with the DUF_6 cylinder project and local traffic similar to that at any other industrial site. Major noise sources within the ETTP site consist of heavy equipment, forklift, and crane operations associated with cylinder handling, steel grit blasting operations, welding/burning/hotwork activities during breach repairs, etc. (Cain 2002a).

ETTP is in a rural setting, and no residences and sensitive receptors (e.g., schools, hospitals) are located in the immediate vicinity. As part of hearing protection for workers, industrial hygiene measurements of noise associated with the DUF_6 cylinder project have been made since 1998. Ambient noise levels around the site are relatively low. Measurements taken at the nearby residence along Popular Creek Road (off Blair Road) to the north of the site on June 1991 at 8:30 a.m. indicated about 39 dB(A), typical of a rural environment (ANL 1991b). At three residences on Blair Road nearest the site, noises from the K-25 activities were not distinguishable from background noise. To date, there have been no complaints about noise from neighboring communities.

3.2.4 Geology and Soil

3.2.4.1 Topography, Structure, and Seismic Risk

The topography of the Oak Ridge site is varied; the maximum change in elevation across the site is about 420 ft (130 m). The site is underlain by sedimentary rocks composed of limestone and dolomite. Sinkholes, large springs, and other karst features can occur in the limestone formations adjacent to the site (DOE 1995).

The ETTP site is situated in the Valley and Ridge Subregion of the Appalachian Highlands Province near the boundary with the Cumberland Plateau (DOE 1995). This subregion consists of a series of northeast-southwest trending ridges bounded by the Cumberland Escarpment on the west and by the Blue Ridge Front on the east.

The major stratigraphic units underlying the site and its confining ridges are the Rome Formation (silty shale and shale), the Conasauga Group (calcareous shale interbedded with limestone and siltstone), the Knox Group (silty dolomite), and the Chickamauga Limestone (interbedded with layers of bentonite). These units range in age from Lower Cambrian (Rome Formation) to Middle Ordovician (Chickamauga Limestone). Contacts between the members are gradational and discontinuous. Sinkholes, large springs, and other karst features are common in the Knox Group, and areas underlain with limestone or dolomites are, for the most part, classified as karst terrains (DOE 1995).

The most important structural feature near the site is a fault system consisting of the Whiteoak Mountain Fault, which runs through the southeastern corner of the Oak Ridge facility; the Kingston Fault, a parallel fault that occurs north of Poplar Creek; and the Copper Creek Fault, located in Melton Valley. A branch of the Whiteoak Mountain Fault originates just south of the facility and runs due north through its center. None of these faults appear to have any topographic expression, and it is assumed that displacement took place prior to the development of the present surface of erosion (DOE 1979). These faults can probably be considered inactive; no seismic events have been associated with these faults near the site, and no surface movement has been reported along the faults.

3.2.4.2 Soils

The typical soil types of the Valley and Ridge Province at ETTP are red-yellow podsols, reddish-brown laterites, or lithosols (DOE 1979). They are usually strongly leached and acidic and have a low organic content. The thickness of alluvium beneath the site ranges from nearly 0 to 60 ft (0 to 18 m). Soils developed on the Chickamauga Formation, which underlies most of the site, are typically yellow to yellow-brown montmorillonites. The Conasauga Shale, which underlies the southeastern corner of the site, develops a silty brown, tan, greenish, and maroon clay that is micaceous and contains fragments of unweathered parent rock. In upland areas around the site, the Fullerton Soil Series is dominant. This soil has moderate infiltration rates and is moderately drained to well drained. The Nolichucky and Talbott Series soils are the most abundant valley and terrace soils within the site proper. The Nolichucky and Talbott Series soils are similar to the Fullerton Series soils (Geraghty & Miller, Inc. 1989b).

Soil and groundwater data have been collected to determine whether contamination is associated with the Oak Ridge cylinder yards (DOE 1994a). Substances in soil possibly associated with cylinder management activities are uranium and fluoride compounds, which could be released to soil if breached cylinders or faulty valves were present. In 1991, 122 systematic soil samples were collected at the K-yard; these samples had maximum concentrations of 0.14 mg/kg of uranium-235 and 13 mg/kg of uranium-238. Soil samples collected in March 1992 at the K-yard had a maximum uranium concentration of 36 ±2 mg/kg.

In 1994, 200 systematic and 28 biased soil samples were collected in areas surrounding the cylinder yards; the maximum concentrations detected in these samples were 0.83 mg/kg of uranium-235 at the K-1066-F yard (F-yard) and 75 mg/kg of uranium-238 at the E-yard. Groundwater concentrations of total uranium (measured as gross alpha and gross beta) for upgradient and downgradient wells indicate that although some elevated levels of uranium have been detected in cylinder yard soil, no migration to groundwater has occurred (DOE 1994a).

Soil samples collected as part of general site monitoring in the immediate surrounding area in 1994 had the following maximum concentrations: uranium, 6.7 mg/kg; Aroclor® 1254 (a PCB), 0.16 mg/kg; cadmium, 0.34 mg/kg; mercury, 0.15 mg/kg; and nickel, 33 mg/kg (LMES 1996c). Fluoride was not analyzed in the soil samples but is naturally occurring and of low toxicity. Concentrations of uranium in 1995 and 1996 soil monitoring were lower than the previous results (LMES 1996b, 1997b).

As part of ongoing Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)/RCRA investigations, several areas of soil at the ETTP site have been identified as contaminated with radionuclides and/or chemicals. Remediation of this contamination is being implemented as a part of ongoing CERCLA/RCRA activities at the site.

3.2.5 Water Resources

The affected environment for water resources consists of surface water within and in the vicinity of the site boundary and groundwater beneath the site. Analyses of surface water, stream sediment, and groundwater samples have indicated the presence of some contamination resulting from previous gaseous diffusion plant operations. Although several contaminants are present in the water, only small amounts of uranium and fluoride compounds are related to releases from the cylinders.

3.2.5.1 Surface Water

The ETTP site is located near the confluence of the Clinch River (a tributary of the Tennessee River) and Poplar Creek (Figure 3.2-4). Effluent discharge points are located on both Poplar Creek and the Clinch River, and two water withdrawal points are on the Clinch River (DOE 1979).

All waters that drain the ETTP site eventually reach the Tennessee-Ohio-Mississippi water system. The Clinch River provides the most immediate destination for waters discharged from the site and flows southwest into the Tennessee River near Kingston, Tennessee (Geraghty & Miller, Inc. 1989b). A dam constructed in 1963 at River Mile 23.1 created the Melton Hill Reservoir, which establishes the eastern and southeastern boundaries of the Oak Ridge facility. Before this dam was constructed, flows were regulated by Watts Bar Dam, which is located about 38 mi [61 km] downstream from the mouth of the Clinch River. Because of the presence of Melton Hill and Watts Bar dams, the hydrology of the Clinch River-Poplar Creek system is very complex. Average flows in Melton Branch, Whiteoak Creek, and the East Fork of Poplar Creek were 1,120, 4,320, and 21,680 gal/min (4,240, 16,350, and 82,060 L/min), respectively, for a period of record circa 1960. The average daily discharge below Melton Hill Dam was 2 million gal/min (129 m^3/s) for a 39-year period of record (Geraghty & Miller, Inc. 1989b).

The ETTP site contains a series of limited drainage basins through which small streams traverse and ultimately join with the Clinch River (DOE 1979). Poplar Creek (Figure 3.2-4) is one such stream; it receives drainage from an area of 136 mi^2 (352 km^2), including the northwestern sector of the site. The headwaters of the East Fork are collected in the vicinity of Y-12, where they receive treated wastewater in the form of cooling tower blowdown, waste stream condensate, and process cooling water. In the uplands around the site, surface runoff is

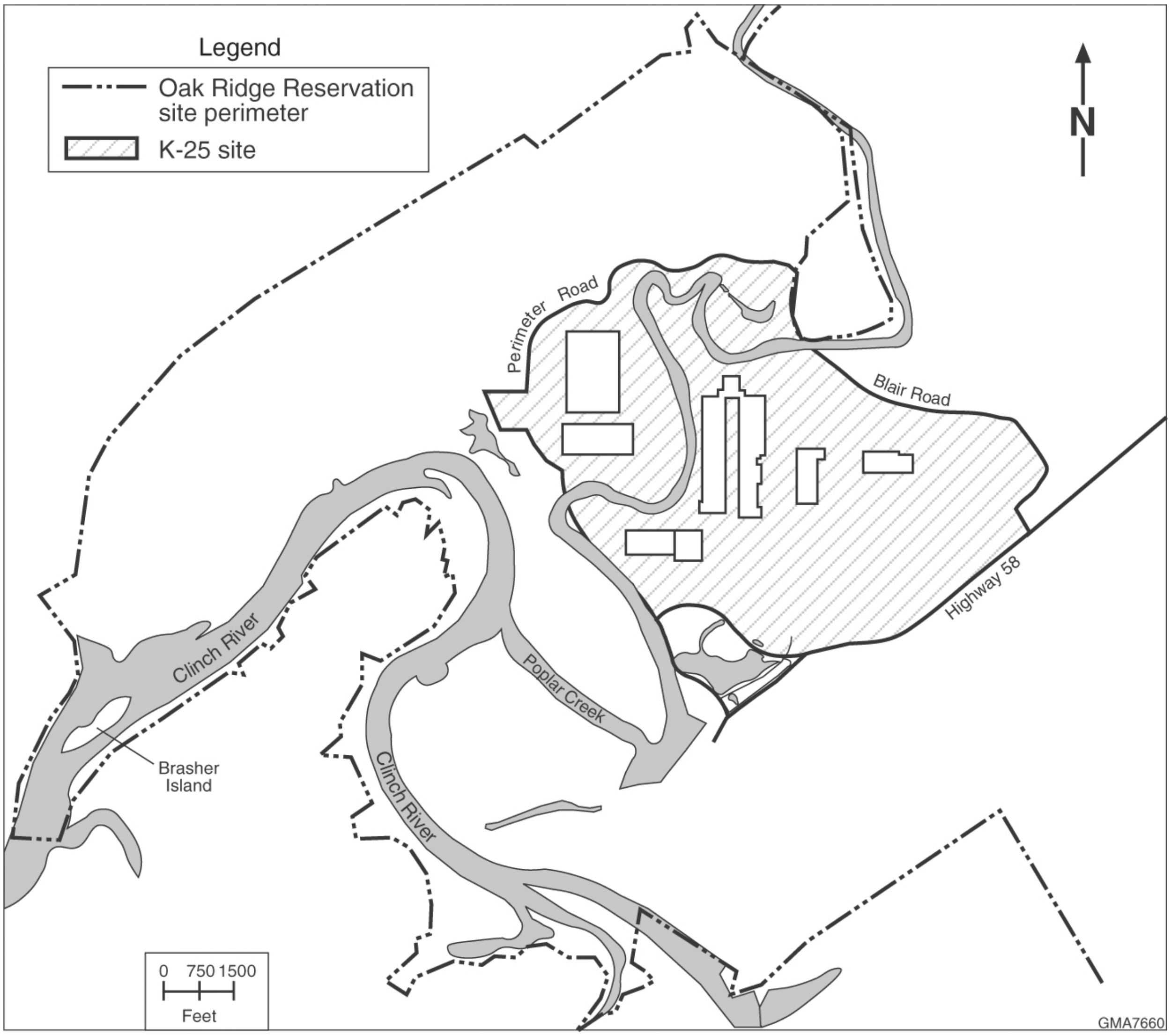

FIGURE 3.2-4 Surface Water Features in the Vicinity of ETTP

largely controlled by soil cover. Within the site, runoff is largely controlled by subsurface drains and diversion ditches. Annual precipitation is 54.8 in. (139 cm). In the vicinity of ETTP, most of the facilities are free from flood hazards for both the 100-year and 500-year maximum probable floods in Poplar Creek (Rothschild et al. 1984).

The ORR site takes water from the Clinch River for makeup cooling water for its reactors at a rate of approximately 20 million gal/d (76 million L/d). An additional 4 million gal/d (15 million L/d) is withdrawn for other process water. These withdrawals occur at Clinch River Miles 11.5 and 14.4. About 25% of this water is returned to the river as treated effluent or blowdown water. Average water consumption for ETTP in 1994 was 1,324 gal/min (5,011 L/min), equaling about 700 million gal (2.6 billion L) per year.

As of 2000, surface water was being monitored at seven locations at ETTP (DOE 2002e). In the last quarter of 1999, sampling at most monitoring stations was scaled back to a semiannual frequency. Uranium levels were well within permitted levels based on radiological standards. In most instances, results for nonradiological parameters were well within their applicable Tennessee water quality standards. Heavy metals were detected, but they were always well within applicable standards. In general, analytical results for samples collected upstream of ETTP were chemically similar to those collected downstream of the site, indicating that the site has little effect on chemical concentrations in surface water.

Sediment samples have also been collected at points that coincided with the ORR water sampling locations. The sediment samples were analyzed for uranium and other parameters. For 1994, the following maximum concentrations were measured: uranium, 43 mg/kg; mercury, 6 mg/kg; nickel, 89 mg/kg; and Aroclor 1254, 10 mg/kg (LMES 1996c).

3.2.5.2 Groundwater

Groundwater occurs in a surficial aquifer and in bedrock aquifers in the vicinity of ETTP. The surficial aquifer consists of man-made fill, alluvium, and the residuum of weathered bedrock (Geraghty & Miller, Inc. 1989b). The depth to unweathered bedrock varies from less than 10 to more than 50 ft (<3 to >15 m), depending on the characteristics of the underlying rocks.

Bedrock aquifers in the area are composed of Cambrian to Ordovician sandstones, siltstones, shales, dolostones, and limestones. The uppermost bedrock aquifer occurs in the Chickamauga Group. This formation disconformably overlies the Knox Dolostone and is the most extensive bedrock unit underlying the site. Shale beds restrict groundwater flow in the aquifer, resulting in concentrated flow along the limestone-shale contact, with resultant solution cavities.

The next-lower aquifer occurs in the Knox Group. It is composed of dolostone with interbeds of limestone. Solution features such as sinkholes and caverns are common and are an important route for groundwater flow. This unit is the principal aquifer on the site (Rothschild et al. 1984); the mean yield of wells and springs is about 268 gal/min (1,014 L/min).

As in the Knox Group, solution cavities in the Conasauga Group are an important controlling influence for groundwater flow. Because shale beds within the group are generally less transmissive, groundwater flow is concentrated in the limestone strata. In addition to solution features, folds and faults can also control flow in this unit (Rothschild et al. 1984). The oldest units in the area are the Shady Dolomite and Rome Formation. Groundwater in these units is largely controlled by fractures and vugs (Geraghty & Miller, Inc. 1989b).

During the late spring and summer of 1981, a series of tests to determine properties of the bedrock aquifers directly across the Clinch River from site K-770 were conducted (Geraghty & Miller, Inc. 1989b). Transmissivity values for the bedrock aquifers (Upper Rome Formation, Chickamauga and Knox Groups) ranged from 22 to 15,000 gal/d per foot (270 to 185,000 L/d per meter), with most values ranging from 22 to 6,000 gal/d per foot

(270 to 73,600 L/d per meter). Slug tests performed in the unconsolidated surficial aquifer indicated that the hydraulic conductivity ranged from 1×10^{-7} to 0.01 cm/s. Bedrock values ranged from 1×10^{-6} to 1×10^{-3} cm/s.

On May 29 and 30, 1991, water-level measurements were collected from 185 of 191 monitoring wells at the ETTP site (Geraghty & Miller, Inc. 1991). Inferred directions of groundwater flow are to the south and southwest toward Poplar Creek. Recharge to the groundwater system occurs from surface water bodies and precipitation.

Groundwater contamination is a significant problem on the site (Rothschild et al. 1984). The problem is compounded by use of land underlain by shallow groundwater (found in most of the valleys on the reservation) and by the presence of direct conduits to groundwater (e.g., solution features and fractures), which are common. Contamination is associated with waste disposal activities, buried pipelines, and accidental spills.

In 1994 and 1995, groundwater samples were collected from a network of between 200 and 225 monitoring wells at the site (LMES 1996b,c). The number of wells monitored was greatly decreased in 1996 as a result of the reorganization of the site into six watersheds and reduced monitoring requirements (LMES 1997b). In the 1994 and 1995 sampling conducted for the larger network of monitoring wells, the following substances were detected at levels exceeding their associated primary drinking water standards: antimony, arsenic, barium, cadmium, chromium (up to 0.741 mg/L), fluoride (only at two wells), lead, nickel (up to 0.626 mg/L), thallium (up to 0.021 mg/L), benzene (up to 6 μg/L), carbon tetrachloride, 1,1-dichloroethene (greater than 1,000 μg/L), chloroform, 1,2 dichloroethene (greater than 1,000 μg/L), methylene chloride, toluene (greater than 1,000 μg/L), 1,1,2-trichloro-1,2,2-trifluoroethane (greater than 1,000 μg/L), TCE (up to 11,000 μg/L), 1,1,1-trichloroethane (up to 140,000 μg/L), 1,1,2-trichloroethane, tetrachloroethene (up to 17 μg/L), vinyl chloride, gross alpha activity (up to 43 pCi/L), and gross beta activity (up to 6,770 pCi/L) (LMES 1996b,c). Aluminum, iron, and manganese also consistently exceeded secondary, non-health-based standards because of the natural geochemical nature of the groundwater underlying the site (LMES 1996b).

Data from the 2000 annual groundwater monitoring program showed that aluminum and lead exceeded maximum contaminant levels for groundwater at ETTP (DOE 2001f). Copper, iron, and zinc were also found at elevated concentrations, but maximum concentration limits (MCLs) are not available for these analytes.

Exit-pathway groundwater surveillance monitoring was conducted in 1994 and 1995 at convergence points where shallow groundwater flows from relatively large areas of the site and converges before discharging to surface water locations (LMES 1996b,c). The exit-pathway monitoring data are representative of maximum groundwater contamination levels at locations where the general public might possibly have access in the future. For 1994, monitoring indicated that thallium, bis(2-ethylhexyl)phthalate, and TCE were present in at least one exit-pathway well sample at concentrations exceeding primary drinking water standards (LMES 1996c). The following average concentrations of these constituents were measured: thallium, 0.007 mg/L; bis(2-ethylhexyl)phthalate, 0.169 mg/L; and TCE, 0.008 mg/L. Alpha activity and fluoride levels were also measured but did not exceed reference levels (average concentration was 4.4 pCi/L for alpha activity and 0.4 mg/L for fluoride). For 1995, monitoring indicated that no inorganic or organic substances exceeded primary drinking water standards; however, alpha activity exceeded the reference level in one well during the spring sampling event (level of 17 pCi/L) (LMES 1996b).

3.2.6 Biotic Resources

3.2.6.1 Vegetation

About 65% of the land within a 5-mi (8-km) radius of the ETTP site is forested, although most of the ETTP site consists of mowed grasses. Oak-hickory forest is the predominant community on ridges and dry slopes. Mixed pine forests or pine plantations, many of which are managed, have replaced former agricultural fields. Selective logging occurred over much of the site before 1986. Cedar barrens are small communities, primarily on shallow limestone soils, that support drought-tolerant species such as little bluestem, dropseed, eastern red cedar, and stunted oak. A cedar barrens across the Clinch River from the ETTP site may be the best example of this habitat in the state and has been designated as a State Natural Area.

3.2.6.2 Wildlife

The high diversity of habitats in the area supports many wildlife species. Ground-nesting species commonly occurring on the ETTP site include red fox, ruffed grouse, and eastern box turtle. Canada geese are also common in the ETTP area, and most are probably residents (ANL 1991a). Waterfowl, wading birds, and shorebirds are numerous along the Clinch River, in its backwaters, and in ponds. Two great blue heron rookeries are located north of the ETTP site on Poplar Creek (ANL 1991a). Species commonly associated with streams and ponds include muskrat, beaver, and several species of turtles and frogs.

The aquatic communities within the Clinch River and Poplar Creek support a high diversity of fish species and other aquatic fauna. Mitchell Branch supports fewer fish species, although the diversity of fish species has increased downstream of most ETTP discharges since 1990 (DOE 2002e; LMES 1996b).

3.2.6.3 Wetlands

Numerous wetlands occur in the vicinity of ETTP, including three small wetlands along Mitchell Branch (ANL 1991a). Extensive forested wetlands occur along Poplar Creek, East Fork Poplar Creek, Bear Creek, and their tributaries. Shallow water embayments of Melton Hill Reservoir and Watts Bar Reservoir support large areas of palustrine emergent wetlands with persistent vegetation. Forested wetlands occur along these marshy areas and extend into tributaries (DOE 1995).

3.2.6.4 Threatened and Endangered Species

No occurrence of state- or federal-listed threatened or endangered species on the ETTP site has been documented. State- and federal-listed species that occur on the ORR are presented in Table 3.2-6. Gray bats, which are federal and state listed as endangered, have been observed on ORR as transient individuals (DOE 2002e). The bald eagle, federal listed as threatened, is a winter visitor on the reservation (DOE 2001f). Bachman's sparrow, state listed as endangered, may be present on ORR, although it has not been observed recently (DOE 2002e). Suitable nesting habitat on the reservation includes open pine woods with shrubs and dense ground cover (ANL 1991a).

3.2.7 Public and Occupational Safety and Health

3.2.7.1 Radiation Environment

Radiation doses to the ETTP cylinder yard workers and to off-site members of the general public are summarized in Table 3.2-7. Exposure to airborne emissions from ETTP operations is approximately 13% of that from operations of the entire ORR. Radiation exposure of the general public MEI is estimated to be 6.7 mrem/yr. This dose is about 7% of the maximum dose limit of 100 mrem/yr set for the general public (DOE 1990) and much smaller than the average dose from natural background radiation in the State of Tennessee. The estimated dose of 6.7 mrem/yr for the MEI was based on the assumption that the off-site public would stay far away from the cylinder yards, which is the case under normal conditions. However, potential external exposure could occur and reach 100 mrem/yr if an off-site individual would spend more than 90 hours in a year immediately at the cylinder yard fence line.

Between 1991 and 1995, the average annual dose to cylinder yard workers ranged from 32 to 92 mrem/yr, which is less than 2% of the maximum radiation dose limit of 5,000 mrem/yr set for radiation workers (10 CFR Part 835). In 1998, 400 cylinders were repainted; the maximum worker exposure was 107 mrem/yr (Cain 2002b).

3.2.7.2 Chemical Environment

Table 3.2-8 gives the estimated hazard quotients for members of the general public under existing environmental conditions near the ETTP site. The hazard quotient represents a comparison of the estimated human intake level of a contaminant with an intake level below which adverse effects are very unlikely to occur. The estimated hazard quotients indicate that exposures to DUF_6-related contaminants in environmental media near the ETTP site are generally a small fraction of those that might be associated with adverse health effects. An exception is groundwater, for which the hazard quotient for fluoride could exceed the threshold of 1. However, it is highly unlikely that this groundwater would be used as a drinking water source.

OSHA has proposed PELs for uranium compounds and HF in the workplace (29 CFR Part 1910, Subpart Z, as of February 2003) as follows: 0.05 mg/m^3 for soluble uranium compounds, 0.25 mg/m^3 for insoluble uranium compounds, and 2.5 mg/m^3 for HF. ETTP worker exposures are kept below these limits.

3.2.8 Socioeconomics

Socioeconomic data for the ETTP site focus on an ROI comprising four Tennessee counties surrounding the site: Anderson, Knox, Loudon, and Roane. The counties included in the ROI were selected on the basis of the current residential locations of government workers directly involved in ETTP activities. The ROI is defined on the basis of the current residential locations of government workers directly connected to ETTP site activities and includes the area in which these workers spend much of their salaries. More than 90% of ETTP workers currently reside in these counties (Cain 2002b). Because the majority of ETTP workers live in Anderson and Knox Counties and in the City of Knoxville, the majority of impacts from ETTP would be expected to occur in these locations; therefore, the following discussions emphasize those areas.

3.2.8.1 Population

The population of the ROI in 2000 was 544,358 people (U.S. Bureau of the Census 2002a) and was expected to reach 565,000 by 2003 (Table 3.2-9). In 2000, 382,032 people (70% of the ROI total) resided in Knox County, 71,330 people resided in Anderson County, and 173,890 people resided in the city of Knoxville itself (U.S. Bureau of the Census 2002a). During

TABLE 3.2-9 Population in the ETTP Region of Influence and Tennessee in 1990, 2000, and 2003

Location	1990	2000	Growth Rate (%), 1990–2000[a]	2003[b] (Projected)
City of Knoxville	165,121	173,890	0.5	176,600
Knox County	335,749	382,032	1.3	397,100
Anderson County	68,250	71,330	0.4	72,300
Loudon County	31,255	39,086	2.3	41,800
Roane County	47,227	51,910	1.0	53,400
ROI total	482,481	544,358	1.2	564,600
Tennessee	4,877,185	5,689,283	1.6	5,958,000

[a] Average annual rate.

[b] ANL projections, as detailed in Appendix F.

Source: U.S. Bureau of the Census (2002a), except as noted.

the 1990s, each of the counties in the ROI and the city of Knoxville experienced moderate increases in population, with an ROI average growth of 1.2%. A slightly higher growth rate was experienced in Loudon County (2.3%), which had the smallest population in the ROI. Over the same period, the population in Tennessee grew at a rate of 1.6%.

3.2.8.2 Employment

Total employment in Knox County was 188,114 in 2000; it was projected to reach 199,400 by 2003. The economy of the county is dominated by the trade and service sectors; employment in those sectors currently contributes more than 75% of all employment in the county (Table 3.2-10). Employment growth in the highest growth sector, the service sector, was 7.1% during the 1990s, compared with 2.0% in the county for all sectors as a whole (U.S. Bureau of the Census 1992, 2002b).

Total employment in Anderson County was 39,797 in 2000; it was projected to reach 42,000 by 2003. The economy of the county is dominated by the manufacturing and service sectors, with employment in those sectors currently contributing more than 82% of all employment in the county (Table 3.2-11). Employment growth in the highest growth sector,

TABLE 3.2-10 Employment in Knox County by Industry in 1990 and 2000

Sector	No. of People Employed in 1990[a]	Percentage of County Total	No. of People Employed in 2000[b]	Percentage of County Total	Growth Rate (%), 1990–2000
Agriculture	2,010[c]	1.3	951[d]	0.5	-7.2[e]
Mining	775	0.5	315	0.2	-8.6
Construction	9,817	6.3	12,225	6.5	2.2
Manufacturing	22,720	14.7	16,912	9.0	-2.9
Transportation and public utilities	9,823	6.3	5,272	2.8	-6.0
Trade	52,258	33.7	41,951	22.3	-2.2
Finance, insurance, and real estate	7,228	4.7	10,668	5.7	4.0
Services	50,032	32.3	99,707	53.0	7.1
Total	154,968		188,114		2.0

[a] U.S. Bureau of the Census (1992).

[b] U.S. Bureau of the Census (2002b).

[c] These agricultural data are for 1992 and are taken from USDA (1994).

[d] These agricultural data are for 1997 and are taken from USDA (1999).

[e] Agricultural data are for 1992 and 1997.

TABLE 3.2-11 Employment in Anderson County by Industry in 1990 and 2000

Sector	No. of People Employed in 1990[a]	Percentage of County Total	No. of People Employed in 2000[b]	Percentage of County Total	Growth Rate (%), 1990–2000
Agriculture	577[c]	1.7	243[d]	0.6	-8.3[e]
Mining	293	0.9	60	0.2	-14.7
Construction	857	2.6	1,175	3.0	3.2
Manufacturing	11,634	34.9	10,523	26.4	-1.0
Transportation and public utilities	801	2.4	218	0.5	-12.2
Trade	5,236	15.7	4,200	10.6	-2.2
Finance, insurance, and real estate	829	2.5	1,058	2.7	2.5
Services	13,016	39.1	22,273	56.0	5.5
Total	33,299		39,797		1.8

[a] U.S. Bureau of the Census (1992).

[b] U.S. Bureau of the Census (2002b).

[c] These agricultural data are for 1992 and are taken from USDA (1994).

[d] These agricultural data are for 1997 and are taken from USDA (1999).

[e] Agricultural data are for 1992 and 1997.

services, was 5.5% during the 1990s, compared with 1.8% in the county for all sectors as a whole (U.S. Bureau of the Census 1992, 2002b).

Total employment in the ROI was 248,003 in 2000; it was projected to reach 262,600 by 2003. The economy of the ROI is dominated by the trade and service sectors; combined, they contribute 72% of all employment in the ROI (see Table 3.2-12). Employment growth in the highest growth sector, services, was almost 6.8% during the 1990s, compared with 1.9% in the ROI for all sectors as a whole (U.S. Bureau of the Census 1992, 2002b). Employment at the ETTP site currently stands at 1,740 (Cain 2002b).

Unemployment in the Knoxville Metropolitan Statistical Area was 2.8% in December 2002, slightly lower than the average rate during the 1990s (Table 3.2-13). Unemployment for the state was 4.1% in December 2002, which is also slightly lower than the average rates for the last 10 years.

TABLE 3.2-12 Employment in the ETTP Region of Influence by Industry in 1990 and 2000

Sector	No. of People Employed in 1990[a]	Percentage of ROI Total	No. of People Employed in 2000[b]	Percentage of ROI Total	Growth Rate (%), 1990–2000
Agriculture	4,528[c]	2.2	2,545[d]	1.0	-5.6[e]
Mining	1,138	0.6	407	0.2	-9.8
Construction	11,185	5.5	14,416	5.8	2.6
Manufacturing	39,633	19.3	32,706	13.2	-1.9
Transportation and public utilities	11,322	5.5	6,682	2.7	-5.1
Trade	61,583	30.1	50,387	20.3	-2.0
Finance, insurance, and real estate	8,851	4.3	12,357	5.0	3.4
Services	66,279	32.3	128,299	51.7	6.8
Total	204,922		248,003		1.9

a U.S. Bureau of the Census (1992).

b U.S. Bureau of the Census (2002b).

c These agricultural data are for 1992 and are taken from USDA (1994).

d These agricultural data are for 1997 and are taken from USDA (1999).

e Agricultural data are for 1992 and 1997.

3.2.8.3 Personal Income

Personal income in Knox County totaled about $11.3 billion in 2000 (in 2002 dollars) and was projected to reach $13.5 billion by 2003. The annual average rate of growth was 2.8% over the period 1990 through 2000 (Table 3.2-14). County per capita income also rose in the 1990s and was expected to reach $34,400 in 2003, compared with about $29,600 at the beginning of the period.

Personal income in Anderson County was almost $2 billion in 2000 (in 2002 dollars) and was expected to reach $2.2 billion by 2003. The annual average rate of growth was 1.9% over the period 1990 through 2000 (Table 3.2-14). County per capita income also rose in the 1990s and was expected to reach $31,100 in 2003, compared with about $27,200 at the beginning of the period.

TABLE 3.2-13 Unemployment Rate in the Knoxville Metropolitan Statistical Area and Tennessee

Location and Period	Rate (%)
Knoxville MSA[a]	
1992–2002 average	3.7
Dec. 2002 (current rate)	2.8
Tennessee	
1992–2002 average	4.6
Dec. 2002 (current rate)	4.1

a Knoxville Metropolitan Statistical Area (MSA) consists of Anderson, Blount, Knox, Loudon, Sevier, and Union Counties.

Source: BLS (2002).

TABLE 3.2-14 Personal Income in Knox and Anderson Counties and ETTP Region of Influence in 1990, 2000, and 2003

Location and Type of Income	1990	2000	Growth Rate (%), 1990–2000	2003 (Projected)[a]
Knox County				
Total personal income (millions of 2002 $)	8,790	11,308	2.8	13,500
Personal per capita income (2002 $)	26,180	29,599	1.4	34,400
Anderson County				
Total personal income (millions of 2002 $)	1,643	1,938	1.9	2,200
Personal per capita income (2002 $)	24,074	27,173	1.4	31,100
Total ROI				
Total personal income (millions of 2002 $)	12,118	15,516	2.8	18,500
Personal per capita income (2002 $)	25,115	28,503	1.4	33,000

[a] ANL projections, as detailed in Appendix F.

Source: U.S. Department of Commerce (2002).

Growth rates in total personal income in the ROI as a whole were the same as those for Knox County and slightly higher than those for Anderson County. Total personal income in the ROI grew at a rate of 2.8% over the period 1990 through 2000 and was expected to reach almost $18.5 billion by 2003. ROI per capita income was expected to grow from about $28,500 in 1990 to $33,000 by 2003, an average annual growth rate of 1.4%.

3.2.8.4 Housing

Housing stock in Knox County grew at an annual rate of 1.8% over the period 1990 through 2000 (Table 3.2-15) (U.S. Bureau of the Census 2002a), with 178,000 housing units expected by 2002, reflecting the growth in county population. Growth in the City of Knoxville during this period was 1.1%, with total housing units expected to reach 86,300 by 2003. During the 1990s, 27,900 new units were added to the existing housing stock in the county, with 8,528 of these units in the city of Knoxville in 2000. Vacancy rates in 2000 stood at 9.8% in the city and 7.9% in the county as a whole for all types of housing. On the basis of annual population growth rates, 14,900 housing units were expected to be vacant in the county in 2003, of which 4,800 were expected to be rental units.

Housing stock in Anderson County grew at an annual rate of 1.0% over the period 1990 to 2000 (Table 3.2-15) (U.S. Bureau of the Census 2002a), with total housing units expected to reach 33,500 in 2003, reflecting moderate growth in county population. Almost 3,130 new units were added to the existing housing stock in the county during the 1990s. Vacancy rates in 2000 stood at 8.2% in the county for all types of housing. On the basis of annual population growth rates, 2,900 housing units were expected to be vacant in the county in 2003, of which 800 were expected to be rental units.

Housing stock grew at a slightly slower rate in the ROI as a whole than it did in Knox County during the 1990s, with an overall growth rate of 1.7%. Total housing units were expected to reach 257,400 by 2003, with more than 38,300 housing units added in the 1990s. On the basis of vacancy rates in 2000, which stood at 8.1%, more than 6,400 rental units were expected to be available in 2003.

TABLE 3.2-15 Housing Characteristics in the City of Knoxville, Knox and Anderson Counties, and ETTP Region of Influence in 1990 and 2000

Location and Type of Unit	No. of Units 1990	No. of Units 2000
City of Knoxville		
Owner-occupied	34,892	39,208
Rental	35,081	37,442
Total unoccupied	6,480	8,331
Total	76,453	84,981
Knox County		
Owner-occupied	85,369	105,562
Rental	48,270	52,310
Total unoccupied	9,943	13,567
Total	143,582	171,439
Anderson County		
Owner-occupied	19,401	21,592
Rental	7,983	8,188
Total unoccupied	1,939	2,671
Total	29,323	32,451
ROI Total		
Owner-occupied	128,300	156,219
Rental	63,331	68,577
Total unoccupied	14,603	19,740
Total	206,234	244,536

Source: U.S. Bureau of the Census (2002a).

3.2.8.5 Community Resources

3.2.8.5.1 Community Fiscal Conditions. Construction and operation of the proposed facility might result in increased revenues and expenditures for local government jurisdictions, including counties, cities, and school districts. Revenues would come primarily from state and local sales tax revenues associated with employee spending during construction and operations, and they would be used to support additional local community services currently provided by each jurisdiction. Tables 1 and 2 of Allison (2002) present information on revenues and expenditures by the various local government jurisdictions in the ROI.

3.2.8.5.2 Community Public Services. Construction and operation of the proposed facility would result in increased demand for community services in the counties, cities, and school districts likely to host relocating construction workers and operations employees. Additional demands would also be placed on local medical facilities and physician services. Table 3.2-16 presents data on employment and levels of service (number of employees per 1,000 population) for public safety and general local government services, and Table 3.2-17 covers physicians. Tables 3.2-18 and 3.2-19 provide staffing data for school districts and hospitals.

TABLE 3.2-16 Public Service Employment in the City of Knoxville, Region-of-Influence Counties, and Tennessee in 2001

Employment Category	City of Knoxville No. of Workers	City of Knoxville Level of Service[a]	Knox County No. of Workers	Knox County Level of Service[a]	Clinton No. of Workers	Clinton Level of Service[a]
Police	429	2.5	495	2.3	24	2.5
Fire[b]	334	1.91.91	0	0.0	18	1.9
General	907	5.2	2,505	11.8	58	6.1
Total	1,670	9.6	3,000	14.1	100	10.6

Employment Category	Lake City No. of Workers	Lake City Level of Service[a]	City of Oak Ridge No. of Workers	City of Oak Ridge Level of Service[a]	Anderson County No. of Workers	Anderson County Level of Service	Tennessee[c] Level of Service
Police	7	3.8	56	2.0	93	2.8	2.4
Fire[b]	3	1.6	42	1.5	0	0.0	1.1
General	19	10.2	256	9.3	336	10.2	39.1
Total	29	15.6	354	12.9	429	13.0	52.6

[a] Level of service represents the number of employees per 1,000 persons in each jurisdiction (U.S. Bureau of the Census 2002a).

[b] Volunteers not included.

[c] 2000 data.

Sources: City of Knoxville: Hatfield (2002); Knox County: Rodgers (2002), Parolari (2002); Clinton: Shootman (2002); Lake City: Hayden (2002); City of Oak Ridge: McGinnis (2002); Anderson County: Worthington (2002); Tennessee: U.S. Bureau of the Census (2002d).

TABLE 3.2-17 Number of Physicians in Knox and Anderson Counties and Tennessee in 1997

Employment Category	Knox County No.	Knox County Level of Service[a]	Anderson County No.	Anderson County Level of Service[a]	Tennessee Level of Service[a]
Physicians	1,519	4.1	209	3.0	2.6

[a] Level of service represents the number of physicians per 1,000 persons in each jurisdiction.

Source: American Medical Association (1999).

TABLE 3.2-18 School District Data for Knox and Anderson Counties and Tennessee in 2001

	Knox County		Anderson County		Tennessee
Employment Category	No.	Student-to-Teacher Ratio[a]	No.	Student-to-Teacher Ratio[a]	Student-to-Teacher Ratio[a]
Teachers	3,380	15.4	488	12.5	15.8

[a] The number of students per teacher in each school district.

Source: Tennessee Department of Education (2001).

TABLE 3.2-19 Medical Facility Data for Knox and Anderson Counties in 1998

Hospital	No. of Staffed Beds	Occupancy Rate (%)[a]
Knox County		
Baptist Hospital of East Tennessee	316	66
East Tennessee Children's Hospital	103	67
County total	319	NA[b]
Anderson County		
Methodist Medical Center of Oak Ridge	250	72
Ridgeview Psychiatric Hospital and Center	20	35
County total	270	NA

[a] Percent of staffed beds occupied.

[b] NA = not available.

Source: Healthcare InfoSource, Inc. (1998).

3.2.9 Waste Management

The ETTP site generates industrial and sanitary waste, including wastewater, solid nonhazardous waste, solid and liquid hazardous waste, radioactive waste, and radioactive hazardous mixed waste. The ETTP site is an active participant in the waste minimization and recycling program within the ORR complex. Much of the waste generated at ETTP is from the ongoing environmental remediation efforts at the site. The ETTP site has the capability to treat wastewater and certain radioactive and hazardous wastes. Some of the wastes generated at ETTP can also be processed or disposed of at facilities located at the Y-12 Plant and ORNL. The ETTP facilities also store and process waste generated at Y-12 and ORNL and wastes from other DOE installations at Paducah, Portsmouth, and Fernald. Most radioactive waste at ETTP is contaminated with uranium and uranium decay products, with small amounts of fission products and TRU radionuclides from nuclear fuel recycling programs. Table 3.2-20 lists the ETTP site waste loads assumed for the analysis of impacts of projected activities in this report.

TABLE 3.2-20 Projected Waste Generation Volumes for ETTP[a]

Waste Category	Waste Treatment Volume (m^3/yr)
LLW	41,000
LLMW	2,700
TRU	0
Hazardous waste	350
Nonhazardous waste[b]	
Solids	12,000
Wastewater	47,000

[a] Volumes include operational and environmental restoration waste projected from FY 2002 to FY 2025. However, it is projected that the majority of the waste would be generated by FY 2008.

[b] Volumes include sanitary and industrial wastes.

Source: Cain (2002c).

3.2.9.1 Wastewater

Treated wastewater at the ETTP site is discharged under an NPDES Permit. Sanitary wastewater is processed at an on-site sewage treatment plant with a capacity of 0.92 million gal/d (3.5 million L/d).

3.2.9.2 Solid Nonhazardous, Nonradioactive Waste

About 35,000 yd^3/yr (27,500 m^3/yr) of solid nonhazardous waste is generated at ORR, which includes waste from the ETTP site. The waste is disposed of at the Y-12 landfill; it is projected that about 50% of the landfill's capacity, or about 920,000 yd^3 (700,000 m^3), would be available in the year 2020.

3.2.9.3 Nonradioactive Hazardous and Toxic Waste

The ETTP site generates both RCRA-hazardous and TSCA-hazardous waste. The site operates several RCRA hazardous waste treatment and storage facilities. The site also operates a permitted TSCA incinerator to treat hazardous and LLMW liquids contaminated with PCBs. The incinerator also processes PCB waste from other facilities at ORR and from off-site DOE installations.

3.2.9.4 Low-Level Radioactive Waste

Current ORR policy for newly generated LLW is to perform necessary packaging for direct shipment to appropriate on- and off-site treatment, storage, and disposal facilities. LLW that is not treated or disposed of at ORR is placed in storage, pending either treatment or disposal or both, at off-site facilities.

3.2.9.5 Low-Level Radioactive Mixed Waste

The majority of radioactive waste generated at ETTP is LLMW, which consists of two categories: (1) aqueous RCRA-hazardous radioactive waste contaminated with corrosives or metals and (2) organic liquids contaminated with PCBs.

Aqueous LLMW is treated on site, and resulting wastewaters are discharged to the NPDES-permitted discharges, which have a capacity of 450,000 yd^3/yr (340,000 m^3/yr). Organic LLMW liquids contaminated with PCBs are treated by the ETTP TSCA incinerator, which has a capacity of 1,800 yd^3/yr (1,400 m^3/yr).

ETTP has the capacity to treat approximately 6,500 yd^3/yr (5,000 m^3/yr) of liquid LLMW via grout stabilization. The site has the capacity to store 88,600 yd^3 (67,800 m^3) of LLMW containers.

3.2.10 Land Use

ETTP is located in east-central Tennessee, in the eastern part of Roane County about 25 mi (40 km) west of the City of Knoxville. An analysis of Landsat satellite imagery from 1992 shows that the dominant land cover categories in Roane County include deciduous forest (42.0%), mixed forest (19.7%), evergreen forest (13.6%), and pasture/hay (10.3%) (Figure 3.2-5). The 1997 agricultural census recorded 99 farms in Roane County, covering more than 53,100 acres (21,489 ha) (USDA 1999). Human settlement is sparse throughout much of the county, with most of the population residing in the communities of Harriman, Kingston, Oak Ridge, and Rockwood. The eastern third of Roane County, where ETTP is located, is dominated by deciduous and mixed forest and pasture.

The 1,700-acre (690-ha) ETTP site contains more than 300 buildings with a combined floor space of 13 million ft^2 (1.2 million m^2) (MMES 1994).

Land use at ETTP focuses on the reuse of facilities, equipment, materials, and utilities previously associated with the gaseous diffusion plant, with an emphasis on reindustralization (Bechtel Jacobs Company LLC 2002). Activities at the site include a range of operations associated with environmental management at the DOE Oak Ridge Operations facilities, such as management of the TSCA incinerator and the treatment, storage, and disposal of hazardous and radioactive waste (including DUF_6) (Operations Management International, Inc. 2002a). Currently, ETTP is home to two business centers: Heritage Center and Horizon Center. The Heritage Center encompasses 125 of the main buildings of the former gaseous diffusion facility, which are currently leased to more than 40 companies (Operations Management International, Inc. 2002b). The Horizon Center encompasses 1,000 acres (447 ha) of building sites aimed primarily at high-tech companies.

3.2.11 Cultural Resources

The ETTP site falls under the cultural resource management plan (CRMP) for ORR. That plan, which contains procedures for managing archaeological sites, historic structures, traditional cultural properties, and Native American sacred sites, was finalized in July 2001 (Souza et al. 2001). Under the plan, ETTP has responsibility for cultural resources at the eastern end of the reservation.

Cultural resource surveys at ORR have provided a considerable body of knowledge regarding the history and prehistory of the area. Archaeological evidence indicates that there has been a human presence at ORR for at least 12,000 years. All the major prehistoric Eastern Woodland archaeological periods are represented there: Paleo-Indian (10,000 B.C.–8,000 B.C.), Archaic (8,000 B.C.–900 B.C.), Woodland (900 B.C.–A.D. 900), and Mississippian (A.D. 900–A.D. 1600). While the ETTP area has not been completely surveyed, six prehistoric sites were identified there. Three of them were determined to be eligible for the *National Register of Historic Places* (NRHP). Five of the six sites lie outside the ETTP security fences. The area within the ETTP security fences underwent massive earthmoving operations during the construction of the gaseous diffusion plant. It is unlikely that unidentified intact archaeological sites remain within the fences (Morris 1998; Souza et al. 2001).

The Overhill Cherokee occupied part of eastern Tennessee from the 1700s until their relocation to Oklahoma in 1838. DOE Oak Ridge Operations has initiated consultations with the Eastern Band of the Cherokee Indians and the Cherokee Nation of Oklahoma regarding Native American issues related to the DUF_6 conversion project at ORR (see Appendix G). No religious or sacred sites, burial sites, or resources significant to the Cherokee have been identified at ETTP to date. However, there are mounds and other prehistoric sites at ORR thought likely to contain prehistoric burials. Similar resources could exist in the unsurveyed portions of the ETTP area (Souza et al. 2001).

Euro-American settlers began entering eastern Tennessee after 1798, and by 1804, settlement of the area that would become ORR in the 20th century had begun. An economy based on subsistence farming and, later, on coal mining developed. A survey of pre-World War II historic structures at ORR was conducted; 254 structures were evaluated, and 41 were recommended as being eligible for the NRHP, in addition to the 6 that were already listed (DuVall and Souza 1996). Two historic archaeological districts were proposed. Of these, the Wheat Community Historic District lies within the ETTP area. It includes 28 contributing structures; one (the George Jones Memorial Church) is already listed on the NRHP. The ETTP site also includes six historic cemeteries (Morris 1998; Souza et al. 2001).

In 1942, the U.S. Army began to acquire land in eastern Tennessee for the Manhattan Project's "Site X." Renamed the Clinton Engineer Works in 1943, the new facility included a gaseous diffusion plant at the K-25 Site. The K-25 Site played a significant role in the production of highly enriched uranium for weapons manufacture between 1944 and 1964, materially contributing to the development of nuclear weapons during World War II and the Cold War. The K-25 site forms the heart of ETTP. Buildings at the ETTP site were evaluated for their historical significance in 1994. One historic district, the Main Plant Historic District, is eligible for the NRHP. The district consists of 157 buildings, 120 of which contribute to the district (37 do not). Eleven additional buildings not adjacent to the district are also considered eligible by virtue of their supporting roles in the uranium-235 enrichment process (DuVall and Souza 1996; Holcombe-Burdette 1998; Souza et al. 2001).

3.2.12 Environmental Justice

3.2.12.1 Minority Populations

This EIS uses data from the most recent decennial census in 2000 to evaluate environmental justice implications of the proposed action and all alternatives with respect to minority populations. The CEQ guidelines on environmental justice recommend that “minority” be defined as members of American Indian or Alaska Native, Asian or Pacific Islander, Black non-Hispanic, and Hispanic populations (CEQ 1997). The earliest release of 2000 census data that included information necessary to identify minority populations identified individuals both according to race and Hispanic origin (U.S. Bureau of the Census 2001). It also identified individuals claiming multiple racial identities (up to six races). To remain consistent with the CEQ guidelines, the phrase “minority population” in this document refers to persons who identified themselves as partially or totally Black (including Black or Negro, African American, Afro-American, Black Puerto Rican, Jamaican, Nigerian, West Indian, or Haitian), American Indian or Alaska Native, Asian, Native Hawaiian or other Pacific Islander, or “Other Race.” The minority category also includes White individuals of Hispanic origin, although the latter is technically an ethnic category. To avoid double counting, tabulations included only White Hispanics; the above racial groups already account for non-White Hispanics. In sum, then, the minority population considered under environmental justice consisted of all non-White persons (including those of multiple racial affiliations) plus White persons of Hispanic origin.

To identify census tracts with disproportionately high minority populations, this EIS uses the percentage of minorities in each state containing a given tract as the reference point. Using the individual states to identify disproportionality acknowledges that minority distributions in the state can differ from those found in the nation as a whole. In 2000, of the 240 census tracts within 50 mi (80 km) of the storage facility at ETTP, 19 had minority populations in excess of state-specified thresholds — a total of 24,235 minority persons in all (Figure 3.2-6). In 2000, 5.2% of the Roane County population was minority (U.S. Bureau of the Census 2002e).

3.2.12.2 Low-Income Populations

As recommended by the CEQ guidelines, the environmental justice analysis identifies low-income populations as those falling below the statistical poverty level identified annually by the U.S. Bureau of the Census in its Series P-60 documents on income and poverty. The Census Bureau defines poverty levels on the basis of a statistical threshold that considers for each family both overall family size and the number of related children younger than 18 years old.

For example, in 1999, the poverty threshold annual income for a family of three with one related child younger than 18 was $13,410, while the poverty threshold for a family of five with one related child younger than 18 was $21,024 (U.S. Bureau of the Census 2000). The 2000 census used 1999 thresholds because 1999 was the most recent year for which annual income data were available when the census was conducted. If a family fell below the poverty line for its particular composition, the census considered all individuals in that family to be below the poverty line.

To identify census tracts with disproportionately high low-income populations, this EIS uses the percentage of low-income persons in each state containing a given tract as a reference point. In 1999, of the 240 census tracts within 50 mi (80 km) of the storage facility at ETTP, 128 had low-income populations in excess of state-specified thresholds — a total of 157,843 low-income persons in all (Figure 3.2-7). In 1999, in Roane County, 13.9% of those individuals for whom poverty status was known were low-income (U.S. Bureau of the Census 2002e).